LeCroy
Digital Oscilloscopes

WaveSurfer Xs Series Service Manual

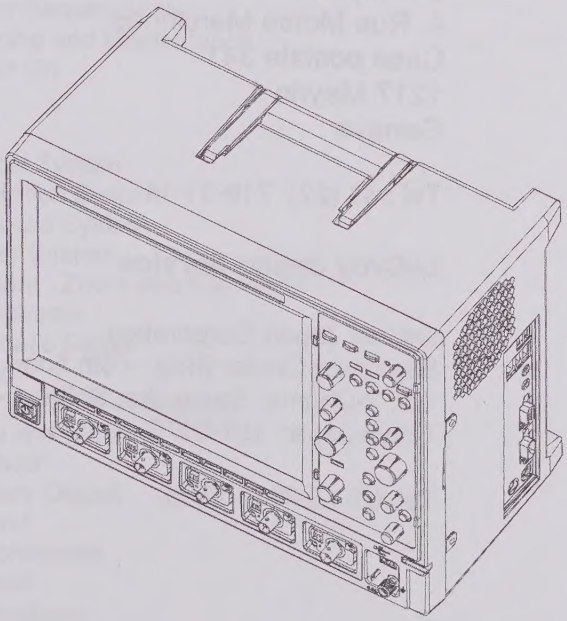
Capture. View. Analyze.

LeCroy

LeCroy Color Digital Oscilloscopes

WaveSurfer Xs Series

Service Manual



Version A - May 2006

LeCroy

LeCroy Corporate Headquarters

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977-6499
USA

Tel : (845) 425-2000
http://www.lecroy.com

LeCroy European Service

LeCroy SA
4, Rue Moïse Marcinhes
Case postale 341
1217 Meyrin 1
Geneva

Tel : 41 (22) 719-21-11

LeCroy Japan Service

LeCroy Japan Corporation
Sasazuka Center Bldg. – 6th floor,
1-6, 2-Chome, Sasazuka, Shibuya-ku
Tokyo Japan 151-0073

Tel. (81) 3 3376 9400

© 2006 by LeCroy Corporation. All rights reserved.

LeCroy, ActiveDSO, ProBus, SMART Trigger, WavePro, and Waverunner are registered trademarks of LeCroy Corporation. JitterTrack, WaveMaster, and X-Stream are trademarks of LeCroy Corporation. Information in this publication supersedes all earlier versions. Specifications subject to change without notice.

LeCroy

Read this first

Warranty 1-1

1. Warranty and Product Support 1-1
1.2 Product Assistance 1-1
1.3 Maintenance Agreements 1-1
1.4 Staying Up to Date 1-2
1.5 Service and Repair 1-2
1.6 How to return a Product 1-2

General Information 2-1

2.1 Product Assistance 2-1
2.2 Installation for Safe and Efficient Operation 2-1
Operating Environment 2-1
Safety Symbols 2-1
Power Requirements 2-3
Cleaning and Maintenance 2-3
Power On 2-3

Specifications 3-1

3.1 Vertical System 3-1
3.2 Acquisition System 3-1
3.3 Timebase System 3-1
3.4 Trigger System 3-2
3.5 Measure , Zoom and Math tools 3-2
3.6 Wavestream 3-2
3.7 Automatic Setup 3-2
3.8 Probes 3-3
3.9 Color Waveform Display 3-3
3.10 Setup and Storage 3-3
3.11 Interface 3-3
3.12 Auxiliary Output 3-3
3.13 General 3-4
3.14 Environmental 3-4
3.15 Physical 3-4
3.16 Certifications 3-4
3.17 Warranty and Service 3-4

Theory of Operation

System Block Diagram		4-1
4.2	Main board	4-2
4.2.1	Front End	4-3
4.2.2	Analog to Digital Converter	4-5
4.2.3	Triggers	4-6
4.2.4	Time Base	4-9
4.2.5	Calibrator	4-10
4.2.6	Scan DAC	4-10
4.2.7	Main Board Control	4-10
4.3	Computer	4-11
4.4	PCI	4-12
4.5	Front Panel	4-13
4.5.1	Key board	4-14
4.6	Display and Touch Screen	4-15
4.7	Power Supply	4-16
4.7.3	Basic Operation	4-17
4.7.7	Control	4-21

Theory of Operation - List of Figures

Figure 4-1 WaveRunner Block Diagram	4-1
Figure 4-2 Acquisition Block Diagram	4-2
Figure 4-3 Front End Block Diagram	4-3
Figure 4-4 Front End Block Diagram 2	4-4
Figure 4-5 HAM631 System	4-5
Figure 4-6 4 and 2 Channel Mode	4-6
Figure 4-7 Trigger Block Diagram	4-7
Figure 4-8 Time Base	4-8
Figure 4-9 Calibrator Block Diagram	4-9
Figure 4-10 PCI Card Block Diagram	4-10
Figure 4-11 Front Panel	4-11
Figure 4-12 Display & Touchscreen	4-12
Figure 4-13 Power Supply Block Diagram	4-13

Performance Verification

5.1	Introduction	5-1
5.1.1	List of Tested Characteristics	5-1
5.1.2	Calibration Cycle	5-1
5.2	Test Equipment Required	5-2
5.2.1	Test Records	5-2
5.3	Turn On	5-2
5.4	Input Impedance	5-3
5.4.1	Channel Input Impedance	5-3
5.4.2	External Trigger Input Impedance	5-6
5.5	Leakage Current	5-7
5.5.1	Channel Leakage Current	5-7
5.5.2	External Trigger Leakage Current	5-10
5.6	Noise Level	5-12
5.7	DC Accuracy	5-17
5.7.1	Positive 50Ω DC Accuracy	5-17
5.7.2	Negative 50Ω DC Accuracy	5-20
5.7.1	Positive 1MΩ DC Accuracy	5-21
5.7.2	Negative 1MΩ DC Accuracy	5-23
5.8	Offset Accuracy	5-25
5.8.1	Positive 50Ω Offset Accuracy	5-25
5.8.2	Negative 50Ω Offset Accuracy	5-27
5.8.3	Positive 1MΩ Offset Accuracy	5-28
5.8.4	Negative 1MΩ Offset Accuracy	5-30
5.9	Bandwidth	5-31
5.9.1	Description	5-31
5.10	Trigger Level	5-36
5.10.1	Description	5-36
5.10.2	Channel Trigger at 0 Division Threshold	5-36
5.10.3	Channel Trigger at +2.5 Divisions Threshold	5-38
5.10.4	Channel Trigger at –2.5 Divisions Threshold	5-38
5.11	Time Base Accuracy	5-39
5.11.1	Description	5-39
5.11.2	Clock Verification Procedure	5-39

Maintenance

6.	Maintenance	6-1
6.1	Introduction	6-1
6.1.1	Safety Precautions	6-1
6.1.2	Anti-static Precautions	6-1
6.2	Disassembly and Assembly Procedure	6-2
6.2.1	Disassembly Procedure	6-2
a.	Removal of the back shell and Box Top	6-2
b.	Removal of the Front Frame Assy	6-4
c.	Removal of the Acquisition System Assembly	6-5
d.	Removal of the Front End Card	6-9
e.	Removal of the Acquisition support plate	6-10
f.	Removal of the PCI card	6-11
g.	Removal of the Power Supply	6-12
h.	Removal of the Processor Board	6-13
i.	Removal of the Front Frame	6-15
j.	Removal of the Hard Drive	6-16
k.	Removal of the Front Panel Encoder Board	6-17
l.	Removal of the Display Inverter Board	6-19
m.	Removal of the Display and Touchscreen	6-20
	Assembly Procedure	6-21
6.3	Software Update Procedure	6-22
6.3.1	Installing New X-Stream DSO Application Software	6-22
6.3.2	Software End User License Agreement	6-25
6.3.3	Installing Device Drivers	6-29
6.3.4	Upgrading Microcode	6-30
6.3.5	Verifying Microcode	6-31
6.3.6	Software Options	6-31
6.3.6.1	Changing Software Option Key	6-31
a.	Scope ID, Scope Serial Number	6-31
b.	Entering Option Key in the DSO	6-32
6.3.7	Restoring the operating System	6-33
6.4	Board Exchange	6-37
6.4.1	PCI Board Exchange Procedure	6-37

Replaceable Parts

See section 7 for a listing of all boards and parts.

Mechanical Parts

See section 8 for a listing of all boards and parts.

1. Warranty and Product Support

It is recommended that you thoroughly inspect the contents of the oscilloscope packaging immediately upon receipt. Check all contents against the packing list/invoice copy shipped with the instrument. Unless LeCroy is notified promptly of any missing or damaged item, responsibility for its replacement cannot be accepted. Contact your nearest LeCroy Customer Service Center or national distributor immediately (see chapter 2 for *contact numbers*).

1.1 Warranty

LeCroy warrants its oscilloscope products for normal use and operation within specifications for a period of three years from the date of shipment. Calibration each year is recommended to ensure in-spec. performance. Spares, replacement parts and repairs are warranted for 90 days. The instrument's firmware has been thoroughly tested and is thought to be functional, but is supplied without warranty of any kind covering detailed performance. Products not made by LeCroy are covered solely by the warranty of the original equipment manufacturer.

Under the LeCroy warranty, LeCroy will repair or, at its option, replace any product returned within the warranty period to a LeCroy authorized service center. However, this will be done only if the product is determined after examination by LeCroy to be defective due to workmanship or materials, and not to have been caused by misuse, neglect or accident, or by abnormal conditions or operation.

1.2 Product Assistance

Note: *This warranty replaces all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. LeCroy shall not be liable for any special, incidental, or consequential damages, whether in contract or otherwise. The client will be responsible for the transportation and insurance charges for the return of products to the service facility. LeCroy will return all products under warranty with transport prepaid.*

Help on installation, calibration, and the use of LeCroy equipment is available from the LeCroy Customer Service Center in your country.

1.3 Maintenance Agreements

LeCroy provides a variety of customer support services under Maintenance Agreements. Such agreements give extended warranty and allow clients to budget maintenance costs after the initial three-year warranty has expired. Other services such as installation, training, enhancements, on-site repairs and calibrations are available through special supplemental support agreements.

1.4 Staying Up to Date

LeCroy is dedicated to offering state-of-the-art instruments, by continually refining and improving the performance of LeCroy products. Because of the speed with which physical modifications may be implemented, this manual and related documentation may not agree in every detail with the products they describe. For example, there might be small discrepancies in the values of components affecting pulse shape, timing or offset, and — infrequently — minor logic changes. However, be assured the scope itself is in full order and incorporates the most up-to-date circuitry. LeCroy frequently updates firmware and software during servicing to improve scope performance, free of charge during warranty. You will be kept informed of such changes, through new or revised manuals and other publications.

Nevertheless, you should retain this, the original manual, for future reference to your scope's hardware specifications.

1.5 Service and Repair

Please return products requiring maintenance to the Customer Service Department in your country or to an authorized service facility. The customer is responsible for transportation charges to the factory, whereas all in-warranty products will be returned to you with transportation prepaid. Outside the warranty period, you will need to provide us with a purchase order number before we can repair your LeCroy product. You will be billed for parts and labor related to the repair work, and for shipping.

1.6 How to return a Product

Contact the nearest LeCroy Service Center or office to find out where to return the product. All returned products should be identified by model and serial number. You should describe the defect or failure, and provide your name and contact number. In the case of a product returned to the factory, a Return Authorization Number (RAN) should be used.

Return shipments should be made prepaid. We cannot accept COD (Cash On Delivery) or Collect Return shipments. We recommend air-freighting.

It is important that the RAN be clearly shown on the outside of the shipping package for prompt redirection to the appropriate LeCroy department.

***Note:** Wherever possible, please use the original shipping carton. If a substitute carton is used, it should be rigid and packed so that that the product is surrounded by a minimum of four inches or 10 cm of shock-absorbent material.*

2. General Information

2.1 Product Assistance

Help on installation, calibration, and the use of LeCroy equipment is available from your local LeCroy office, or from LeCroy's

- Customer Care Center, 700 Chestnut Ridge Road, Chestnut Ridge, New York 10977–6499, U.S.A., tel. (845) 578–6020
- European Service Center, 4, Rue Moïse Marcinhes, Case postale 341, 1217 Meyrin 1, Geneva Switzerland, tel. (41) 22/719 21 11.
- LeCroy Japan Corporation, Sasazuka Center Bldg – 6th floor, 1-6, 2-Chome, Sasazuka, Shibuya-ku, Tokyo Japan 151-0073, tel. (81) 3 3376 9400

2.2 Installation for Safe and Efficient Operation

Operating Environment

The oscilloscope will operate to its specifications if the environment is maintained within the following parameters:

Temperature .....5 to 40 °C (41 to 104 °F) rated.

Humidity .....Maximum relative humidity 80 % RH (non-condensing) for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C

Altitude .....2000 m (6560 ft)

The oscilloscope has been qualified to the following EN61010-1 category:

Installation (Overvoltage) CategoryII

Pollution Degree 2

Safety Symbols

Where these symbols or indications appear on the front or rear panels, and in this manual, they have the following meanings:

CAUTION: Refer to accompanying documents (for Safety-related information). *See elsewhere in this manual wherever the symbol is present,as indicated in the Table of Contents.*

CAUTION: Risk of electric shock

On (Supply)

Off (Supply)

Earth (Ground) Terminal

Protective Conductor Terminal

Earth (Ground) Terminal on BNC Connectors

WARNING ..... **Denotes a hazard. If a WARNING is indicated on the instrument, do not proceed until its conditions are understood and met.**

WARNING

Any use of this instrument in a manner not specified by the manufacturer may impair the instrument's safety protection.

The oscilloscope has *not* been designed to make direct measurements on the human body. Users who connect a LeCroy oscilloscope directly to a person do so at their own risk.

Power Requirements

The oscilloscope operates from a 115 V (90 to 132 V) or 220 V (180 to 250 V) AC power source at 45 Hz to 66 Hz. No voltage selection is required, since the instrument automatically adapts to the line voltage present.

Maintain the ground line to avoid an electric shock.

None of the current-carrying conductors may exceed 250 V rms with respect to ground potential. The oscilloscope is provided with a three-wire electrical cord containing a three-terminal polarized plug for mains voltage and safety ground connection.

The plug's ground terminal is connected directly to the frame of the unit. For adequate protection against electrical hazard, this plug must be inserted into a mating outlet containing a safety ground contact.

Cleaning And Maintenance

Maintenance and repairs should be carried out exclusively by a LeCroy technician Cleaning should be limited to the exterior of the instrument only, using a damp, soft cloth. Do not use chemicals or abrasive elements. Under no circumstances should moisture be allowed to penetrate the oscilloscope. To avoid electric shocks, disconnect the instrument from the power supply before cleaning.

CAUTION **Risk of electrical shock: No user serviceable parts inside. Leave repair to qualified personnel.**

This page intentionally left blank

3. Specifications

3.1 Vertical System

	WaveSurfer 24xs	WaveSurfer 44/42xs	WaveSurfer 64/62xs	WaveSurfer 104xs
Bandwidth (at probe tip)	400 MHz	400 MHz	600 MHz	1000 MHz
Rise Time	1.75ns	875 ps	625 ps	400 ps
Input Channels	4	4/2	4/2	2
Bandwidth Limiters	20MHz	20 MHz; 200 MHz		
Input Impedance	1 MΩ || 16 pF			
Input Coupling	50Ω: DC, 1 MΩ: AC, DC, GND			
Maximum Input Voltage	50Ω: 5 Vrms, 1 MW: 400 V max (DC + Peak AC: ≤ 5 kHz)			
Vertical Resolution	8 bits			
Sensitivity	50Ω: 2 mV/div - 1 V/div fully variable; 1 MΩ: 2 mV - 10 V/div fully variable			
DC GainAccuracy	±1.0% of full scale (typical); ±1.5% of full scale, ≥ 10 mV/div (warranted)			
Offset Range	50Ω: ±1 V @ 2-98 mV/div, ±10 V @ 100 mV/div - 1 V/div; 1 MΩ: ±1 V @ 2-98 mV/div, ±10 V @ 100 mV/div - 1 V/div, ±100 V @ 1.02 V/div - 10 V/div			
Offset Accuracy	±(1.5% of offset value + 0.5% of full scale +1 mV)			
Input Connector	ProBus ®/BNC			

3.2 Acquisition System

Sample Rate (single-shot)	2.5 GS/s (all channels)
Sample Rate (RIS mode)	50 GS/s
Standard Record Length	2 Mpts/Ch (all channels)
Standard Capture Time	up to 800 µs at full sample rate

3.3 Timebase

Timebase Range	200 ps/div - 1000 s/div (roll mode from 500 ms/div to 1000 s/div)
Timebase Accuracy	10 ppm

3.4 Triggering

Standard	Edge, Glitch, Width, Logic (Pattern), TV/Composite Video
Advanced (WS Xs-ADVTRIG)	Runt, Slew Rate, Interval, Dropout, Qualified (State or Edge)

3.5 Measure, Zoom, and Math Tools

Standard Parameter Measurement	Amplitude, Area, Base (Low), Delay, Duty, Fall Time (90%-10%), Fall Time (80%-20%), Frequency, Maximum, Mean, Minimum, Overshoot+, Overshoot-, Period, Peak-Peak, Phase, Rise Time (10%-90%), Rise Time (20%-80%), RMS, Skew, Standard Deviation, Top (High), Width+, Width -.
Zooming	Use front panel QuickZoom button, or use touch screen or mouse to draw a box around the zoom area.
Standard Math	Operators include Sum, Difference, Product, Ratio, and FFT (up to 25 kpts with power spectrum output and rectangular, VonHann, and FlatTop windows). 1 math function may be defined at a time.
Extended Math (WS Xs-MathSurf)	Adds the following additional math functions: Absolute Value, Averaging (summed and continuous), Derivative, Envelope, Enhanced Resolution (to 11 bits), Floor, Integral, Invert, Reciprocal, Roof, Square, and Square Root. Also adds chaining of two math functions, rescaling to different units, and 1Mpt FFTs.

3.6 LeCroy WaveStream Fast Viewing Mode

Intensity	Adjustable via front panel control
Number of Channels	up to 4 simultaneously
Waveforms/second (continuous)	up to 8000 waveforms/second
Operation	Front panel toggle between normal -Time and LeCroy WaveStream Fast Viewing Mode

3.7 Automatic Setup

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals.
Vertical Find Scale	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range.

3.8 Probes

Probes	One PP009 per channel standard; Optional passive and active probes available.
Probe System; ProBus	Automatically detects and supports a variety of compatible probes.
Scale Factors	Automatically or manually selected, depending on probe used

3.9 Color Waveform Display

Type	Color 10.4" flat-panel TFT-LCD with high resolution touch screen
Resolution	SVGA; 800 x 600 pixels
Grid Styles	Single, XY, Single + XY,
Waveform Styles	Sample dots joined or dots only

3.10 Setup Storage

Front Panel and Instrument Status	Store to the internal hard drive, over the network, or to a USB-connected peripheral device.

3.11 Interface

Remote Control	Via Windows Automation, or via LeCroy Remote Command Set
GPIB Port (Optional)	Supports IEEE - 488.2
Ethernet Port	10/100Base-T Ethernet interface (RJ-45 connector)
USB Ports	5 USB 2.0 ports (one on front of instrument) supports Windows-compatible devices.
External Monitor Port	Standard 15-pin D-Type SVGA-compatible DB-15; connect a second monitor to use dual-monitor display mode.
Serial Port	DB-9 RS-232 port (not for remote oscilloscope control)

3.12 Auxiliary Output

Signal Type	Trigger Enabled, Trigger Output. Pass/Fail, or Off
Output Level	TTL,~3.3 V
Connector Type	BNC, located on rear panel

3.13 General

Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum.
Calibrator	Output available on front panel connector provides a variety of signals for probe calibration and compensation.
Power Requirements	90-264 V rms at 50/60 Hz; 115 V rms (±10%) at 400 Hz, Automatic AC Voltage Selection Installation Category: 300V CAT II; Max. Power Consumption: 300 VA/300 W; 250 VA/250 W for WaveRunner 62Xi

3.14 Environmental

Temperature: Operating	+5 °C to +40 °C
Temperature: Non-Operating	-20 °C to +60 °C
Humidity: Operating	5% to 80% RH (non-condensing) up to 30 °C, Upper limit derates linearly to 45% RH (non-condensing) at 40 °C
Humidity: Non-Operating	5% to 95% RH (non-condensing) as tested per MIL-PRF-28800F
Altitude: Operating	3,048 m (10,000 ft.) max at ≤ 25 °C
Altitude: Non-Operating	12,190 m (40,000 ft.)

3.15 Physical

Dimensions (HWD)	260 mm x 340 mm x 152 mm (excluding feet) 10.25" x 13.4" x 6"
Net Weight	6.8 kg. (15 lbs.)

3.16 Certifications

CE Compliant, UL and cUL listed; Conforms to EN 61326, EN 61010-1, UL 61010-1 2nd Edition,
and CSA C22.2 No. 61010-1-04.

3.17 Warranty and Service

3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, calibration, and customization services.

This page intentionally left blank

4. Theory of Operation

4.1 System Block Diagram

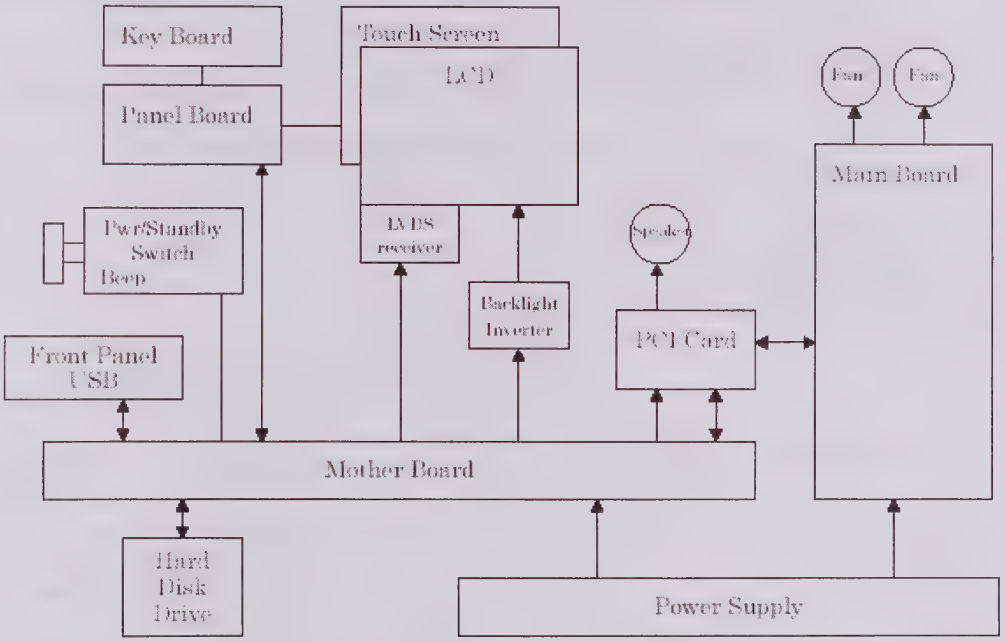


Figure 4-1 WaveSurfer Block Diagram

4.2 Main Board

The main board is divided into the following sections:

- **Front End**
  Based on high impedance buffer, variable gain amplifier and differential amplifiers.
- **Analog to Digital Converter**
  Based on the HAM631 and the relay switchyard to combine the input channels.
- **Trigger**
  Based on the Hybrids HTR420 discriminator & MST429A smart trigger.
- **Time Base**
  Based on the MCG426 clock generator & MTB411A controller.
- **Calibrator**
- **SCAN DAC**
- **Main Board Control**

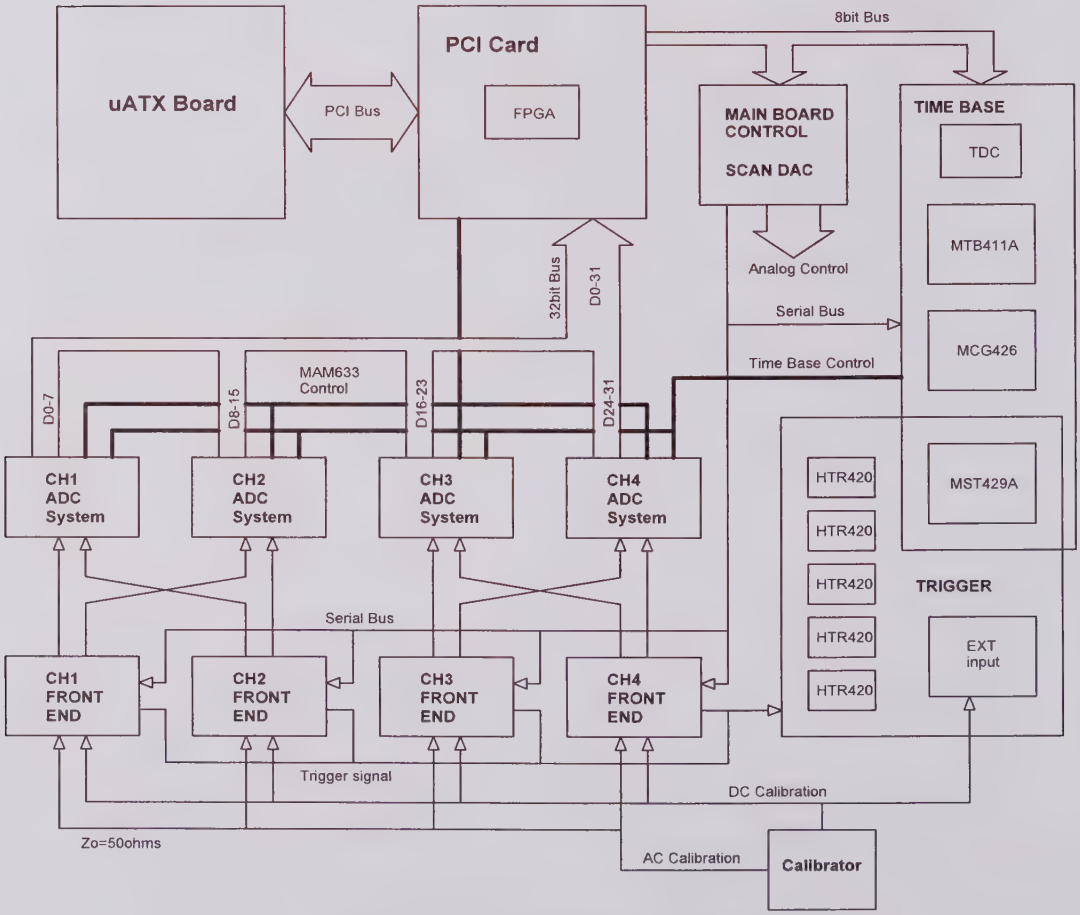


Figure 4-2 Acquisition Block Diagram

4.2.1 Front End

The front end processes an analog signal for ADC and trigger, consists of 1M ohms attenuators, high impedance buffer, 200 ohms attenuator, variable gain amplifier SA5209D and differential amplifiers.

The main functions of the Front end without the amplifiers are:

- Four channels operation, calibration with Software control.
- Input protection (clamp + thermal detection) and coupling (AC, DC, 1MΩ, 50Ω).
- Attenuator by 5, by 10, by 50, by 100 & by 500.
- Offset control of ±1V.
- Detection of 50Ω over loading.
- Input of signal for DC calibration and skew calibration.

The main functions of SA5209D and differential amplifiers are:

- Amplitude normalization for the ADC system : at the BNC the dynamic range is 16 mV to 80V FS (full scale) and the ADC/TRIG system input is 500 mV differential.
- Fine adjustment of gain and variable control.
- Band width limiter of 20MHz, 200MHz.
- Switch for channel combine mode.

Control

Relay control

The relay of the attenuator is set by selecting the input coupling and the gain as shown in the table below.

All relays are driven with +5V/0V.

Input coupling

Control port	Relay	GND	1M,DC	1M,AC	50,DC
CAL	RL2	H	L	L	L
1M/*50	RL1	H	H	H	L
AC/*DC	RL5	H	L	H	L
1/*10	RL3	H	X	X	X
1/*100	RL4	L	X	X	X

Switch of attenuator

Control port	Relay	2mV-49mV	50mV-0.49V	0.5V-10V
1/*10	RL3	H	L	L
1/*100	RL4	H	H	L

Divide gain

The gain ratio in each block and input range is a table below.
At the BNC the dynamic range is 16 mV to 80V FS (full scale) and the output is 500 mV differential (HAD631 input).

	Range V/div											
Block	2mV	5mV	10mV	20mV	50mV	100mV	200mV	500mV	1V	2V	5V	10V
ATT 1/*10	1	1	1	1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ATT 1/*100	1	1	1	1	1	1	1	1	0.1	0.1	0.1	0.1
ATT 1/5	1	1	1	0.2	1	1	0.2	1	1	0.2	0.2	0.2
SA5209D	31.25	12.5	6.25	15.62	1.25	6.25	15.62	1.25	6.25	15.62	6.25	3.125
Total(ratio)	31.25	12.5	6.25	3.125	1.25	0.625	0.3125	0.125	0.0625	0.03125	0.0125	0.00625

Analog control voltage

Circuit name	signal level	Signal name
CHx OFFSET	+/-4V	Offset control signal for Front End
CHx GAIN	+/-4V	SA5209D gain control signal
CHx OS ADJ	0 to +4V	Offset control signal for differential amplifiers
INT CAL	-6V to +6V	Signal each CH commonness for calibration

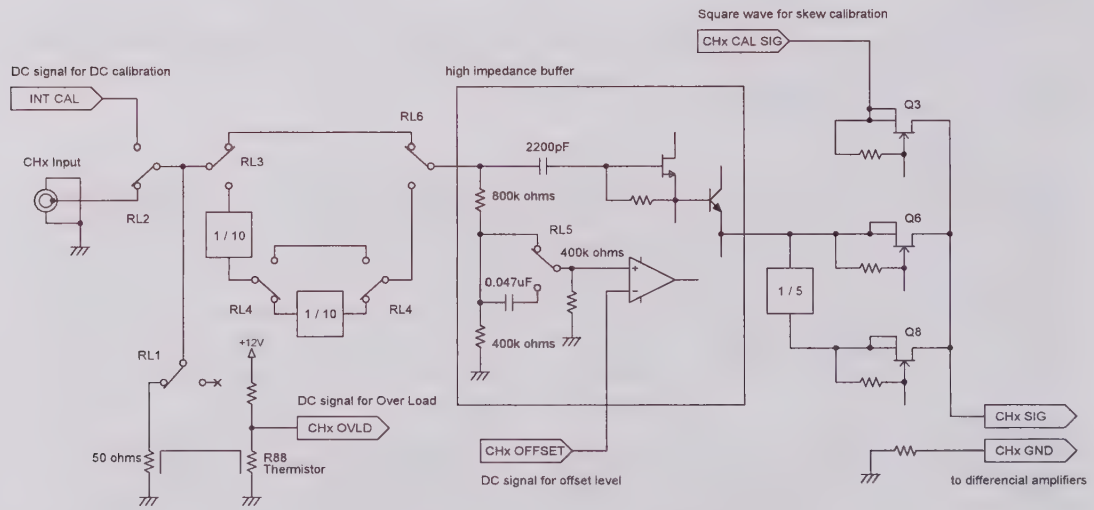


Figure 4-3 Front End Block Diagram 1

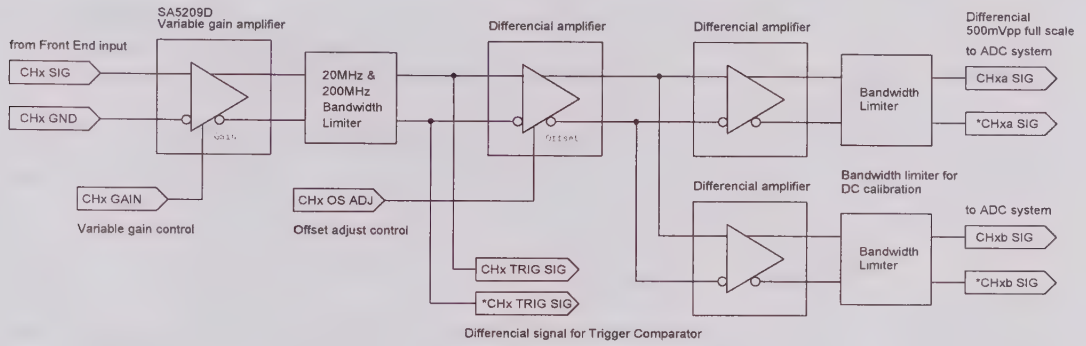


Figure 4-4 Front End Block Diagram 2

4.2.2 Analog to Digital Converter

The analog to digital converter system does the signal conversion to 8 bits, using the HAM631:
The system has the relay switchyard to combine the input channels.

- **HAM631**
  Hybrid ADC 1GS/s with 4Mb memory. It consists of MAD442 and MAM633.
  Provide 83 MHz clock for memory and refresh for DRAM.

Analog Control voltage

Circuit name	signal level	Signal name
CHx ADGAN	0 to +4V	Adjust ADC gain (+/-15%)
CHx ADOFS	0 to +4V	Adjust ADC offset (+/-100mV)
CHx ADDLY	0 to +4V	Adjust ADC sampling delay (+/-250ps)

These are mainly used on channel combine mode.

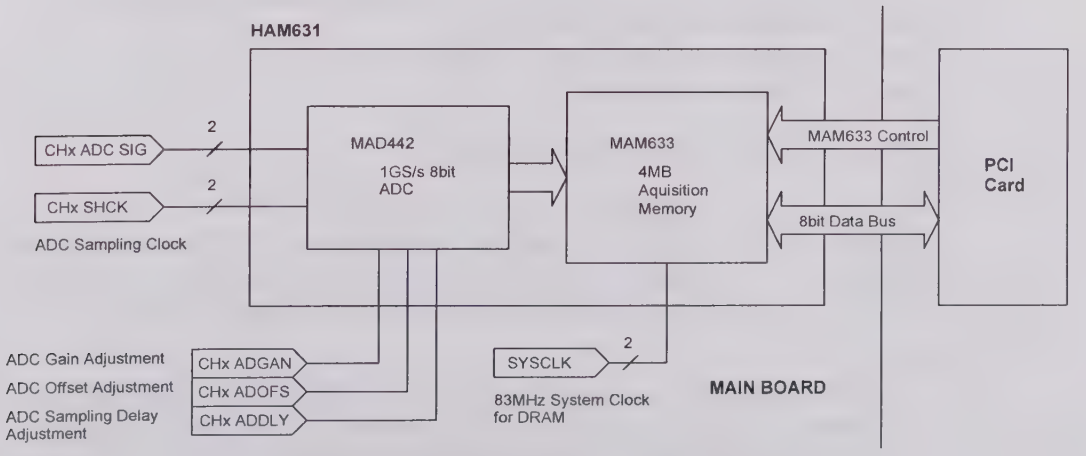


Figure 4-5 HAM631 System Architecture

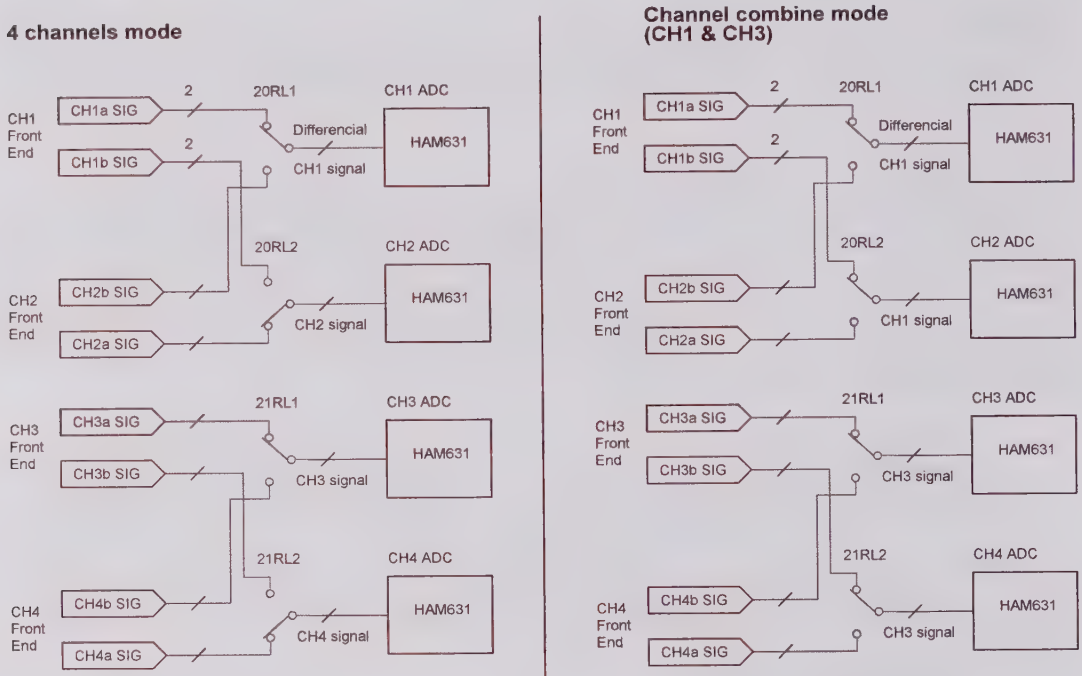


Figure 4-6 4 & 2 Channel Mode

4.2.3 Trigger

HTR420

The main function of HFE420 are:

- Generation of trigger signal (analog input and digital output) with comparator
- Setting of trigger level (TRIG,VALIDATE)
- Setting of trigger coupling (DC,AC,LFREJ,HFREJ,HF)
- Setting of slope (+,-,WINDOW)

The different trigger couplings using HTR420 are :

- DC
- AC : cut off frequency is almost 7.5 Hz.
- LF REJ : single pole high pass filter with a cut off frequency at 50 kHz.
- HF REJ : single pole low pass filter with a cut off frequency at 50 kHz.
- HF : frequency divider by four for high frequency signal.

TV Trigger

Each channel has a pick-off after the HTR420. Selected trigger source goes to commercial chip (LM1881) via AGC amplifier and provides three outputs (Composite Sync. Output, Vertical Sync. Output, and ODD/EVEN output) to the MST429A.

MST429A

The main function of MST429A are:

- generates main trigger signal for Time Base system

The trigger function of MST429A are:

- Single source trigger,
  - Standard trigger,
  - Hold off by Time
  - Hold off by Events,
  - Pulse width
  - Interval
- Multiple source trigger,
  - State qualified,
  - Edge qualified

Analog Control voltage

Circuit name	signal level	Signal name
CHx TRIG LVL1	+/-4V	Trigger level control signal
CHx TRIG LVL2	+/-4V	Trigger level control signal for smart trigger/window
CHx HYST	0 to +4V	Trigger hysteresis control signal

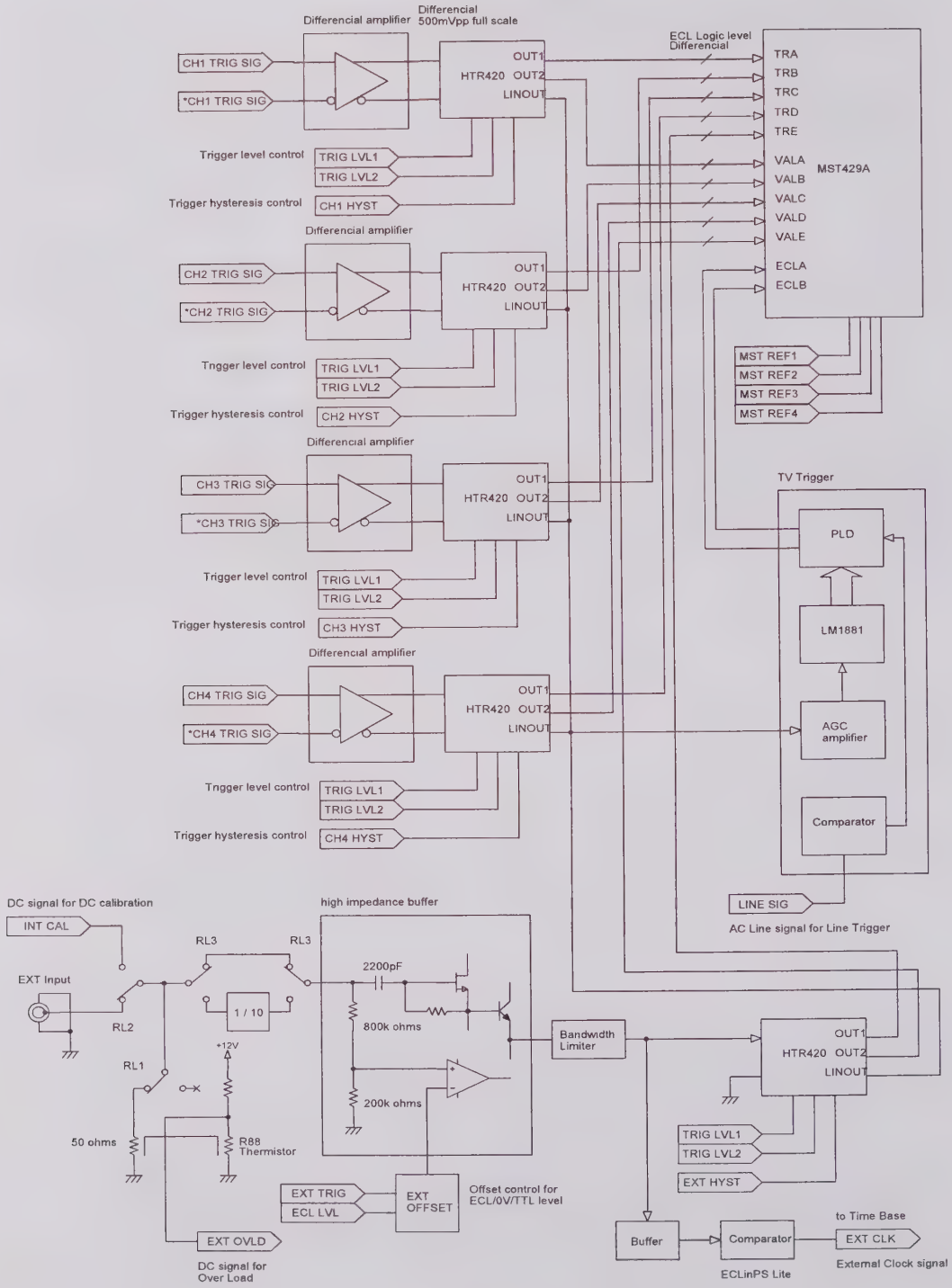


Figure 4-7 Trigger Block Diagram

4.2.4 Time Base

The time base includes four circuits:

- **MCG426**: generates sampling clocks: 12.5 MHz up to 2GHz
  generates clocks for the MTB411
  interleaves sampling clocks to increase sampling rate and memory depth.
- **MTB411A**: Time Base System
  Trigger circuitry
  Main oscillator circuitry
  Frequency divider for a Probe Calibrator
- **TDC**: Time to Digital Converter interpolator and Real Time computation
- **MST429A**: generates main trigger signal for Time Base system.

Analog Control voltage

Circuit name	signal level	Signal name
MST REF1	+/-4V	Reference signal for analog time of Smart trigger
MST REF2	+/-4V	Reference signal for analog time of Smart trigger
MST REF3	+/-4V	Reference signal for analog time of Smart trigger
MST REF4	+/-4V	Reference signal for analog time of Smart trigger
TDC ADJ	0 to +4V	TDC gain control signal

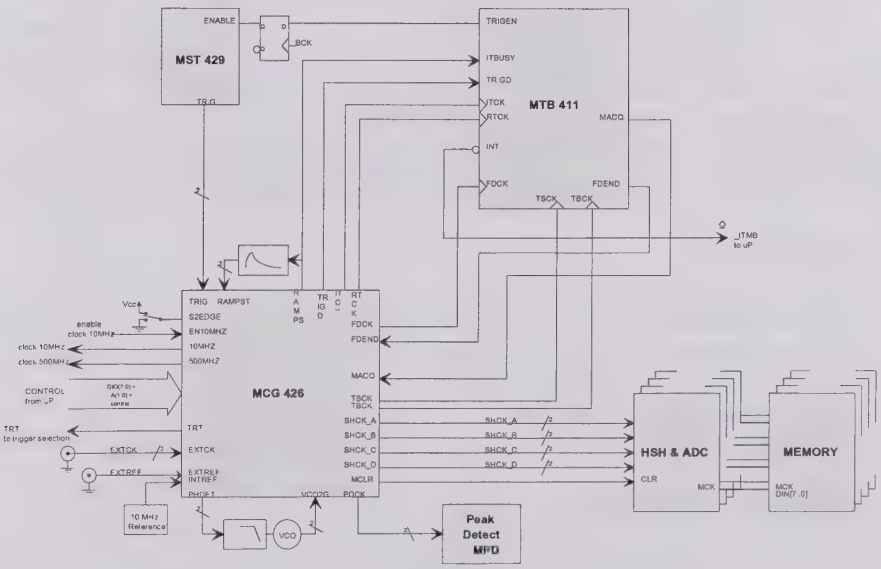


Figure 4-8 Time Base Block Diagram

4.2.5 Calibrator

The main functions of the Calibrator are:

- Probe calibration signal output.
- DC calibration signal output.
- Skew calibration signal output.

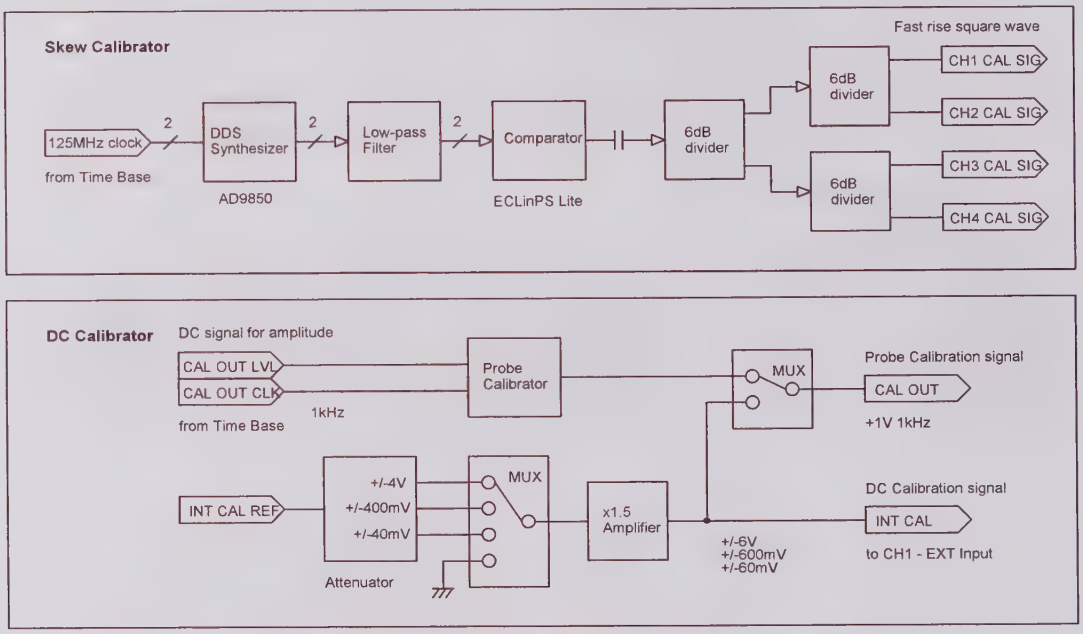


Figure 4-9 Calibrator Block Diagram

4.2.6 SCAN DAC

The main functions of the SCAN DAC are:

- 16 bit precision DAC with uP system.
- 24 analog control signal outputs.
- +/-4V dynamic range outputs.
- 16 ADC inputs for Probe sense, overload detection and so on.

4.2.7 MAIN BOARD CONTROL

The main functions of MAIN BOARD CONTROL are:

- 3 wire Serial Bus for serial device control.
- IIC Bus for EEPROM, Thermometer and ProBus system.
- 16 Analog control outputs using 10 bit DAC.
- 12 Analog control outputs using 8 bit DAC.
- Interface between Main Board and PIC Card.

4.3 Computer

The WaveSurfer processor is an 850 MHz Intel Celeron processor. This motherboard was designed for embedded system.

4.3.1 Operating System

The system uses Microsoft Windows XP embedded as the operating system. The operating system license can be found on the rear panel of the instrument.

4.3.2 Memory

The standard memory configuration for a WaveSurfer is 256MB, consisting of 1 piece of 32M x64 Bit PC-2100 DDR DIMM.

4.3.3 Interfaces

The standard interfaces provided by the Motherboard to external are SVGA, Audio, Ethernet, RS-232, Centronics, three USBs(side 2, front 1), PS/2 Keyboard and PS/2 Mouse. Also one USB and IDE port provided by the Motherboard are used inside the unit for Front panel and HDD.

4.3.4 Storage Devices

The system has an internal hard drive of at least 30 GB in size. 10 GB is allocated for LeCroy use, 16 GB is in a user partition for the saving of panel setups, waveform memory, hard copies, application programs, user data, etc. The balance is allocated as invisible partition for system recovery data

4.3.5 Video port

The Mother board has an on-board video display processor with a LVDS output as well as the ability to drive a rear panel external display. This external port is enabled on power up if it an external monitor is sensed. If the monitor is connected after the initial power on, the power to the instrument must be cycled in order for this monitor to operate.

4.4 PCI Card

The PCI card is the interface between the PCI bus on the processor card and the rest of the system (acquisition system and amplifier for speaker). It has the following interfaces:

- PCI interface (32 bit 33MHz bus with bus mastering capability)
- Acquisition data interface using 32bit local bus.
- Acquisition control interface using 8bit local bus.
- Dallas OneWire interface and chip for scope id.
- Audio amplifier for internal speaker.

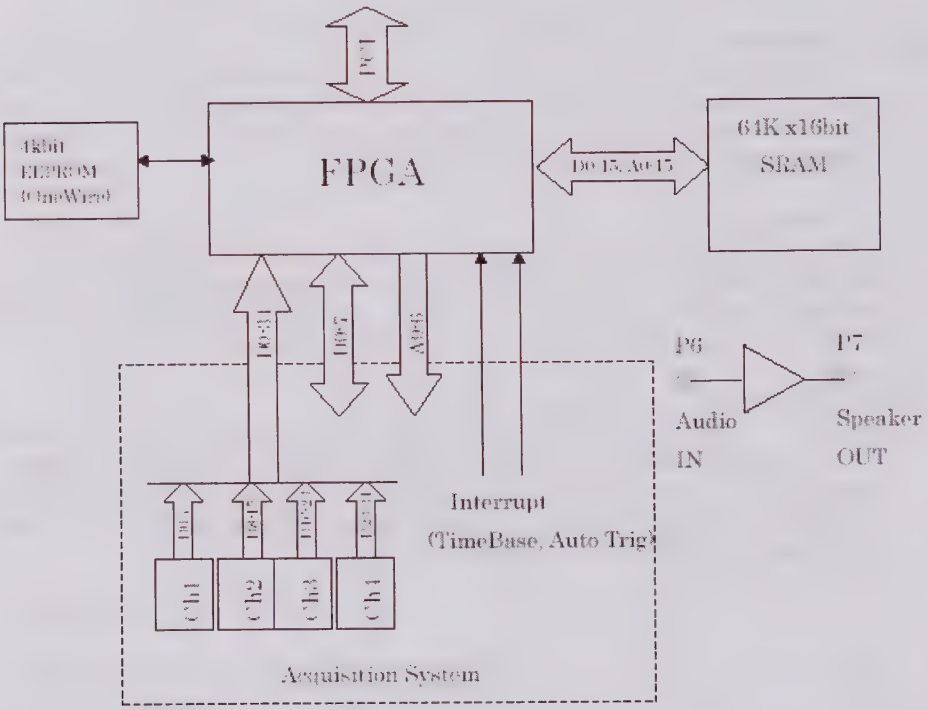


Figure 4-10 PCI Card Block Diagram

4.4.1 PCI Interface

The PCI interface is implemented with a Xilinx FPGA. It is a 32 bit, 33 MHz bus master that allows the PCI card to take control of the PCI bus and push data directly into the processor memory without requiring the direct involvement of the processor. In readout mode, the FPGA reads the data and puts it in the correct time order for the processor memory. The FPGA also has a special readout mode to access the acquisition data in roll mode, store the data, and then transfer this data in blocks to the processor memory. This implementation is the most complicated but is needed in order to maximize the PCI throughput.

4.4.2 Local bus for acquisition

The acquisition interface consists of 2 local buses to read out acquisition data and to control the main board.

4.4.2.1 Control

All resource on main board is controlled through 8bit local bus.

4.4.2.2 Acquisition Data

32bit local bus is used to access the acquisition memories. Each 8bit is connected to each channel's memories directly. (bit0-7 is connected to ch1, bit8-15 is connected to ch2, bit16-23 is connected to ch3 and bit24-31 is connected to ch4)

4.4.3 Dallas OneWire Interface

The Dallas onewire interface is controlled by FPGA. The 4kbits EEPROM is connected to this interface. This device has unique id to generate scope id.

4.4.4 Audio amplifire

The audio amplifier to drive internal speaker is on PCI board. This is independent from other PCI function.

4.5 Front Panel

The front panel consists of two assemblies, the panel board and the key board assembly.

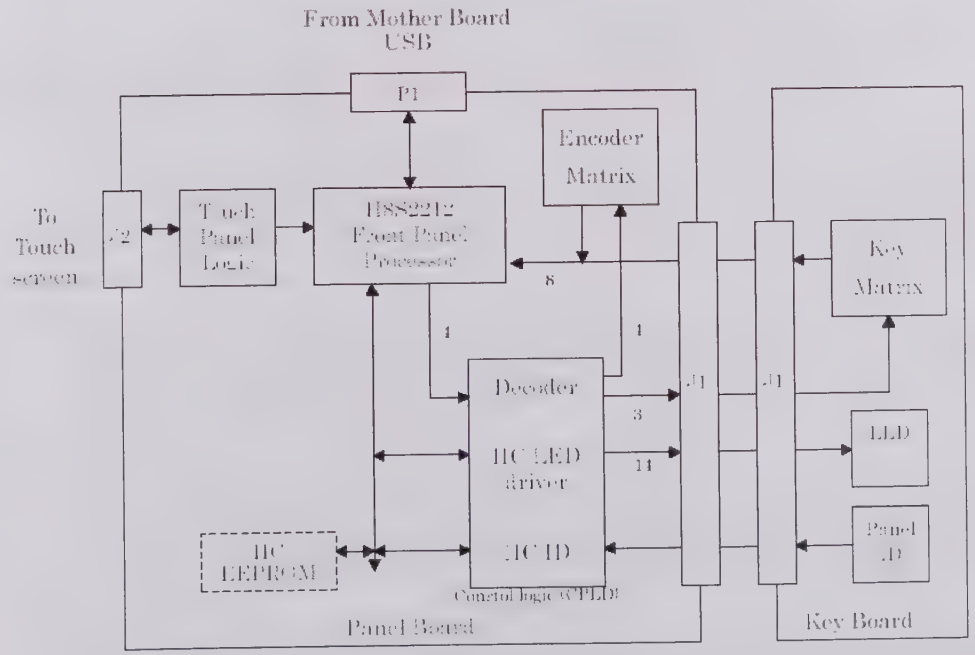


Figure 4-11 Front Panel Block Diagram

4.5.1 Key board

The front panel assembly consists of the panel board PCB, the panel board metal,the elastomeric keypad and the key board PCB. The key board PCB connects to the panel board assembly which is connected to the mother board by USB. The key board has the LED's which illuminate some of the front panel buttons and has trace patterns which act as switches when the elastomeric keypad shorts the traces together in response to a key press.

The key board has configuration jumper which must be selected based on the identification of the front panel (2 channel model or 4 channel model).

4.5.2 Panel Board

Panel board consists of rotary encoder function and touchscreen function.

The encoder status, the front panel key status and the touch panel status is read by the front panel processor, the H8S2212. Power for the panel board comes from the cable of the USB.

4.5.2.1 Encoders

The panel board contains all of the rotary encoders. There are two different types of encoders on this assembly, some have a push switch, others do not. The V/Div and timebase use encoders that do not have push switch, the rest of the encoders have a push switch. The encoders contain two switches, they are not potentiometers. The software can determine the direction and speed the encoder is turning based on the order and frequency of make and break connections of these internal switches.

4.5.2.2 Touchscreen Interface

Provides a control interface to a 4-wire resistive touchscreen. The pointing location is measured by 4 A/D convertors in the front panel processor.

4.6 Display and Touchscreen

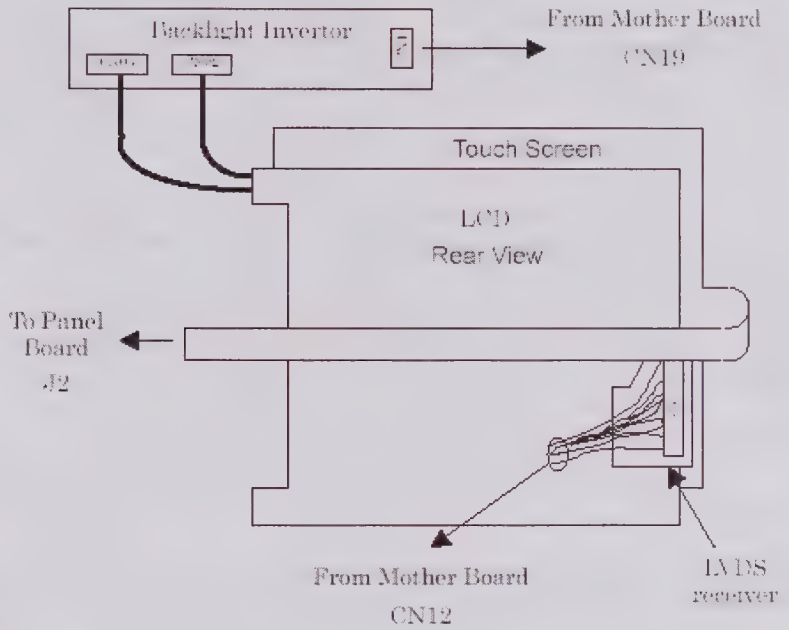


Figure 4-12 Display & Touchscreen Block Diagram

4.6.1 Color LCD Module

The display module is an SHARP TFT (thin film transistor) active matrix color liquid crystal display (LCD) module comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight. The 26cm diagonal display area contains 800x600 pixels (SVGA) and can display 262144 colors simultaneously.

4.6.2 Backlight Inverter

The inverter which supplies power to the LCD's backlight is supplied with +12V from the Mother board, it then converts this to 1000-2000V AC to drive the CCFT (Cold Cathode Fluorescent Tube). There is also a signal from the Mother board which controls the On/Off of the backlight.

4.6.3 Touch Screen

The touch screen is a 4 wire resistive touch screen. It must be calibrated so that software can determine where a touch corresponds to a position on the screen. This calibration is done at four points and can be invoked through the Utilities menu.

4.6.4 LVDS receiver

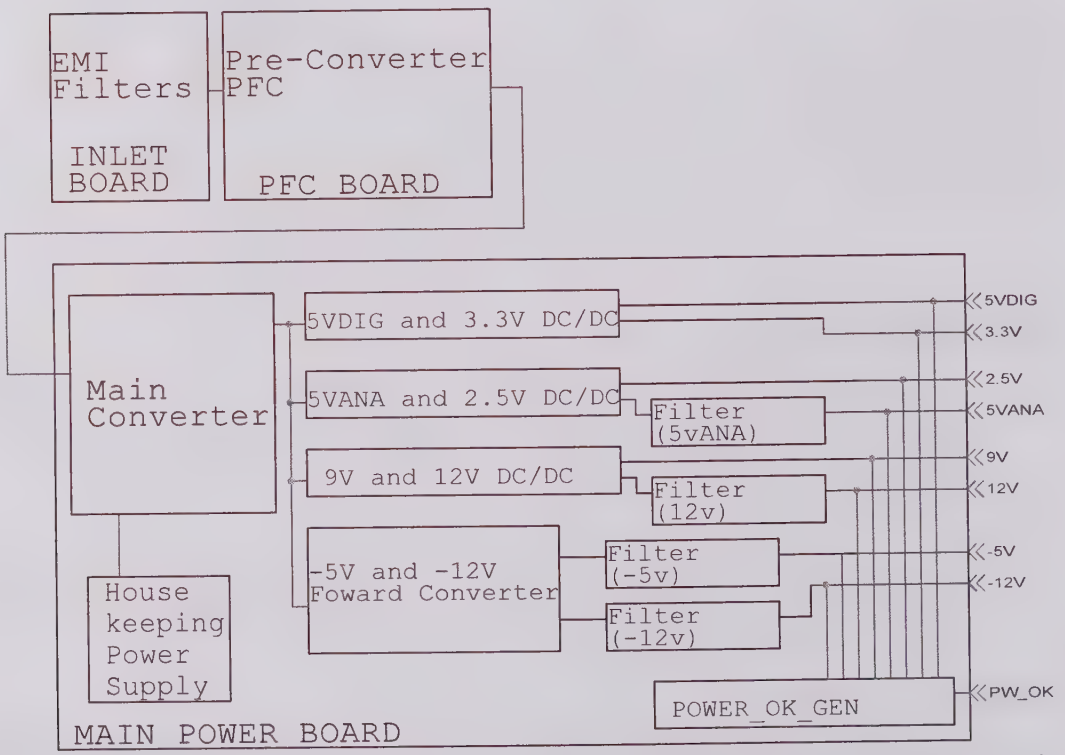
Mother board has LVDS output for LCD. LVDS receiver receive the LVDS signal from Mother board, it then converts this to 18bits RGB (each color has 6bits depthfor input type of LCD module.

4.7 Power Supply

Do not touch any electric parts inside the power supplies during operation as the primary side of the power unit has many high voltage portions to ground.

Power Supply Unit comprises of INLET BOARD, PFC BOARD and MAIN BOARD.

The INLET BOARD includes EMI Filters.
The PFC BOARD includes Pre-converter, which is operated Power Factor Correction.
The MAIN BOARD includes Main Converter (off line), House Keeping Power Supply, Post Converters, Filters, Power OK Generater circuit and internal Bias Supply Circuits.



Solid Line Blocks represent Daughter Boards.

Figure 4-13 Power Supply Block Diagram

4.7.1 Input Voltages

The power supply supports a wide ranges of inputs, 90-132 V AC (45-65HZ, 360-440Hz) and 90-264V AC (45-65Hz) are allowed.

4.7.2 Output Voltages

The power supply makes several output voltages:

OUTPUT VOLTAGE	"TOTAL" REGULATION BAND	Min. Load	Typ. Load	Max. Load	CAPACITIVE LOADING	
					Minimum Capacitance	Maximum Capacitance
+5.0Vana (RS)	+/-1%	0.1A	4.0A	4.2A	1200μF	1800μF
-5.0V (RS)	+/-1%	1.0A	5.0A	5.25A	1200μF	1600μF
+9.0V	+/-2%	0.1A	0.4A	0.5A	330μF	390μF
+2.5V	+/-5%	0.1A	1.0A	1.4A	1400μF	2000μF
+12.0Vana	+/-1%	0.1A	0.16A	1.16A	330μF	560μF
-12.0V	+/-2%	0.1A	0.62A	1.7A	330μF	560μF
+5.0Vdig	+/-5%	0.1A	3.1A	5.5A	2400μF	10000μF
+12Vdig	+/-5%	0.1A	1.0A	1.24A	500μF	1000μF
3.3V	+/-5%	0.1A	2.0A	3.0A	4000uF	6000uF
5.0V(stand)	+/-5%	0.1A	0.1A	1.0A		

Note: RS represent Remote Sense.

4.7.3 Basic Operation

The power supply utilizes 5 converter, 5 synchronous step- down switching regulator and step-down switching regulator.

4.7.3.1 Pre-converter

Power Factor Correction (PFC) circuit. It uses a Critical Mode Boost Converter topology switching and using MosFETs as the primary switches. The output of the PFC Converter is regulated to 385VDC.

4.7.3.2 Main Converter

The converters are like dual-switch half-bridge converters switching at approximately 88KHz and utilizing the module integrated controller and two MosFETs as the primary switches. Output is regulated using a post switching regulation scheme. The output has its own raw voltage provided on its own separate winding on the transformers. The output is regulated to 24V secondary bus voltage,.

4.7.3.3 House Keeping Power Supply

It is a fly back converter switching at approximately 80 kHz. The bias supply also provides other voltages for internal housekeeping. The bias supply is "ON" whenever AC is present. +5VSB is provided from an step-down switching regulator.

4.7.3.4 +5VDIG and 3.3V DC/DC(Daughter Board)

Dual 2-phase synchronous step-down switching regulator is used for the +5Vdig and +3.3V supply.

4.7.3.5 +5VANA and 2.5V DC/DC (Daughter Board)

Dual 2-phase synchronous step-down switching regulator is used for the +5.0Vana and 2.5V supply.

4.7.3.6 +9 and 12V DC/DC (Daughter Board)

Step-down switching regulator is used for the +9.0V supply. Synchronous step-down switching regulator is used for the +12V supply.

4.7.3.7 -5V and –12V Forward converter

This converter is used for the –5.0V supply. There is also a linear regulator which supplies the –12V supply.

4.7.3.8 Filter Circuits (Daughter Boards)

The Filter circuits are implemented for analog outputs ;+5.0V,+12.0V,-5.0V and –12.0V.

4.7.4 Connector Assignments

The power supply connectors are arranged as follows:

INLET BOARD

Reference	Supplied BOARD	Connector	Pin#	Voltage /Function	Comment
1CN2	PFC BOARD	5566-2A	Total 2	Input AC Line	

PFC BOARD

2CN2	INLET BOARD	5566-2A	Total 2	Input AC Line	
2CN3	MAIN BOARD	5566-2A	1	385VDC	
			2	Primary Return	
2CN1	MAIN BOARD	5267-3A	1	18.5VDC	
			2	Primary Return	
			3	Traiac Bias	
2CN4	MAIN BOARD	5267-2A	1	Line	
			2	GND	

MAIN BOARD

Primary

3CN1	PFC BOARD	5267-3A	1	18.5VDC	
			2	Primary Return	
			3	Triac Bias	

5CN2	PFC BOARD	5566-2A	1	385VDC	
			2	Primary Return	

Secondary

Reference	Supplied BOARD	Connector	Pin#	Voltage /Function	Comment
CN9	EXT BOARD	5566-2A	1	24V	Bus Voltage
			2	GND	

5CN1	EXT BOARD	5267-3A	1	24V	To printer
			2	N.C	
			3	GND	

CN2	Main Board	51067	1,2	+5.0V	
			3,6	GND	
			4,5	-5.0V	
			7,8	+2.5V	

CN3	Main Board	51067	1	+12.0V	
			2,4	GND	
			3	+9.0V	
			5	-12.0V	

CN4	Main Board	5268-07A	1	-12.0V	F.B –12.0V
			2	+12.0V	F.B +12.0V
			3	-5.0V	F.B –5.0V
			4	+5.0V	F.B +5..0V
			5	LINE	Line tiger Signal
			6	BAT EN	Battery EN.
			7	BAT VS	Battery V.S.

CN5	Main Board FAN MOTOR	5568-02A	1	+12Vdig	
			2	GND	

Reference	Supplied BOARD	Connector	Pin#	Voltage /Function	Comment
CN6	UATX-Board	5566-20A	1,2,11	3.3Vdig	
			3	GND	
			4	5.0Vdig	
			5,7,13	GND	
			6,19,20	5.0Vdig	
			8	PWR_OK	TTL level
			9	+5.0Vstb	Standby Power
			10	+12.0Vdig	
			12	-12Vdig	
			15,16,17	GND	
			14	PS_ON#	<0.8V:ON/>2V:OFF
			18	-5.0Vdig	

CN11	PFC BOARD	5267-02A	1	LINE	
			2	GND	

CN7	EXT Board	5267-06A	1	GND	
			2	REMOTE_ON	
			3	BAT VS	
			4	BAT EN	
			5	Vaux	
			6	5Vstd	

CN10	EXT Board	5267-02A	1	24V	External OUT
			2	GND	

4.7.5 Output Voltage Adjustment Range

Each output voltage has an adjustment range of the nominal Vset voltage as specified in the table. The adjustments are clearly labeled and accessible from the top of the Power Supply. Turning adjustment potentiometers clockwise increases the absolute value of output voltages.

4.7.6 +5VSB Standby Supply Rail

+5VSB is a standby supply output that is active whenever the AC power is present. It provides a power source for the processor standby circuits that must remain operational when the other main DC output rails are in a disabled state. The 5VSB output is capable of delivering up to 0.5A continuously with the fan not operating.

4.7.7 Control

The following control signals are required.

4.7.7.1 Output Enable OUTPUT-EN/ (active low)

This is an active low signal which comes from the processor board that turns on (enables) all of the power supply DC outputs.

4.7.7.2 Line Frequency Synchronization Output Signal (LFS)

The LFS signal is safety-isolated from the primary circuits of the power supply. The LFS signal is a digital signal (TTL levels) that toggles at each zero-crossing of the AC line input.

4.7.7.3 PWR_OK signal

PWR_OK is a “power good” signal. It is asserted high by the power supply a minimum of 100ms after all Secondary Outputs are above the minimum voltage as specified by the lower limit of the regulation band and the AC line is present. The PWR_OK rise time is <= 10ms. In the case of AC line disconnection or drop-out, the PWR_OK signal goes low when at least one of Secondary Outputs drop out of regulation.

4.7.8 Over-Current Protection

All outputs are protected against damage due to overloads or short circuits. Short circuit current levels for any output, unless specified below, will not exceed 125% of maximum current for that output.
Each output has independent current limiting, that is the over-current of any of these outputs will not cause any other output except –5.0V Output. If –5.0V output will short, -12.0V output reduces output voltage. The over current circuitry is latch type. Whenever Over-Current protection occur, all Outputs shut down to protect Circuitry damage. –5V output only have over-current adjustment value(6A) and adjustment potentiometer.

4.7.9 Over-Temperature Protection

The power supply will shut down before any damage occurs from over-temperature. This is true independent of the cause of the over-temperature condition (i.e. blocked power supply cooling fan, excessive ambient temperature, etc.) When the power supply restart , the power supply must remove AC Line for a few minutes and remove the cause of the over-temperature condition.

4.7.10 Over-Voltage Protection

Over-voltage protection is required to reduce the likelihood of damage to system components in the event of a single point fault within the power supply. All outputs incorporate an over-voltage protection limited to less than 135% of the nominal Vset values. When the power supply restart , the power supply must remove AC Line for a few minutes and remove the cause of the over-Voltage condition.

5. Performance Verification

5.1 Introduction

This chapter contains procedures suitable for determining if the WaveSurfer Xs Series of Digital Storage Oscilloscope performs correctly and as warranted. They check all the characteristics listed in subsection 5.1.1.

In the absence of the computer automated calibration system based on LeCroy Calibration Software (Calsoft), this manual performance verification procedure can be followed to establish a traceable calibration. It is the calibrating entities' responsibility to ensure that all laboratory standards used to perform this procedure are operating within their specifications and traceable to required standards if a traceable calibration certificate is to be issued for the WaveSurfer Xs Digital Storage Oscilloscope.

5.1.1 List of Tested Characteristics

This subsection lists the characteristics that are tested in terms of quantifiable performance limits.

- Input Impedance
- Leakage Current
- Sdev noise level
- Positive and Negative DC accuracy
- Positive and Negative Offset
- Bandwidth
- Trigger Accuracy
- Time Base Accuracy

5.1.2 Calibration Cycle

The WaveSurferXs Digital Storage Oscilloscope requires periodic verification of performance. Under normal use (2,000 hours of use per year) and environmental conditions, this instruments calibration cycle is 12 months.

5.2 Test Equipment Required

These procedures use external, traceable signal generators, DC precision power supply and digital multi-meter, to directly check specifications. If a low noise precision DC calibrator is used no attenuators are needed.

Instrument	Specifications	Recommended
Signal Generator Radio Frequency	Frequency : .5 MHz to 2 GHz Frequency Accuracy : 1 PPM	HP 8648B/C, Fluke 9500 or equivalent
Signal Generator Audio Frequency	Frequency : 0 to 5 kHz Amplitude : 8 V peak to peak	HP 8648B/C, Fluke 9500 or equivalent
Voltage Generator DC Power Supply	Range of 0 to 20 V, in steps of no more than 15 mV	HP 8648B/C, Fluke 9500 or equivalent
Power Meter + Sensor	Accuracy ±1 %	HP437B + 8482A or equivalent
Digital Multimeter Volt & Ohm	Voltmeter Accuracy : 0.1 % Ohmmeter Accuracy : 0.1 %	Keithley 2000, or equivalent
2 Coaxial Cable	50Ω, BNC, length 100 cm,	
2 Attenuators	20db 50Ω, BNC, 1 % accuracy	
T adapter	50Ω, BNC T adapter	
Terminator	50Ω, BNC, 1 % accuracy	

Table 5-1 : Test Equipment

5.2.1 Test Records

The last pages of this document contain WaveSurferXs test records in the format tables. Keep them as masters and use a photocopy for each calibration.

5.3 Turn On

If you are not familiar with operating the WaveSurferXs, refer to the operator's manual and getting started guide.

- Switch on the power using the power switch.
- Wait for about 20 minutes for the scope to reach a stable operating temperature.

- Insert a removable USB device with panel setups (e.g. Memory stick, CD ROM drive).

5.4 Input Impedance

WS6x/4x Specifications	WS104Xs Specifications
DC 50Ω ±1.0 %	DC 50Ω ±1.5 %
EXT DC 50Ω ±1.0 %	EXT DC 50Ω ±1.5 %
DC 1MΩ ±1.0%	DC 1MΩ ±1.25%

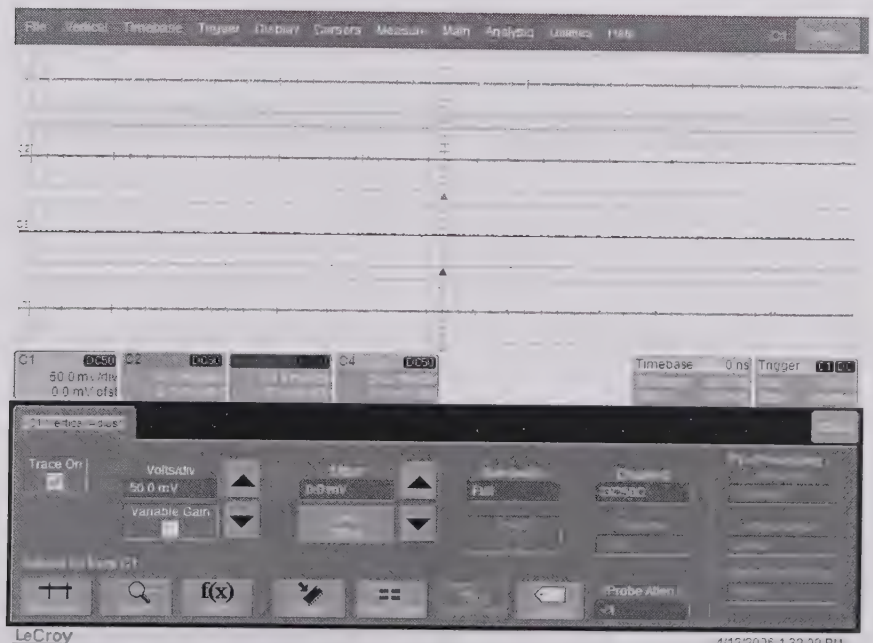
The impedance values for 50Ω and 1MΩ coupling are measured with a high precision digital multimeter. The DMM is connected to the DSO in 4 wire configuration (input and sense), allowing for accurate measurements. ***Check that the DMM used is measuring the 1 MΩ inputs in at least a 3 MΩ range. If tested in a lower range some readings may not be within specifications.***

5.4.1 Channel Input Impedance

a. DC 50Ω

- Recall **Input Impedance - 50 ohm x1.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input gain	:	**20 mV/div.** on all 4 Channels
Time base	:	**50 ηsec/div.**
Trigger mode	:	**Auto**

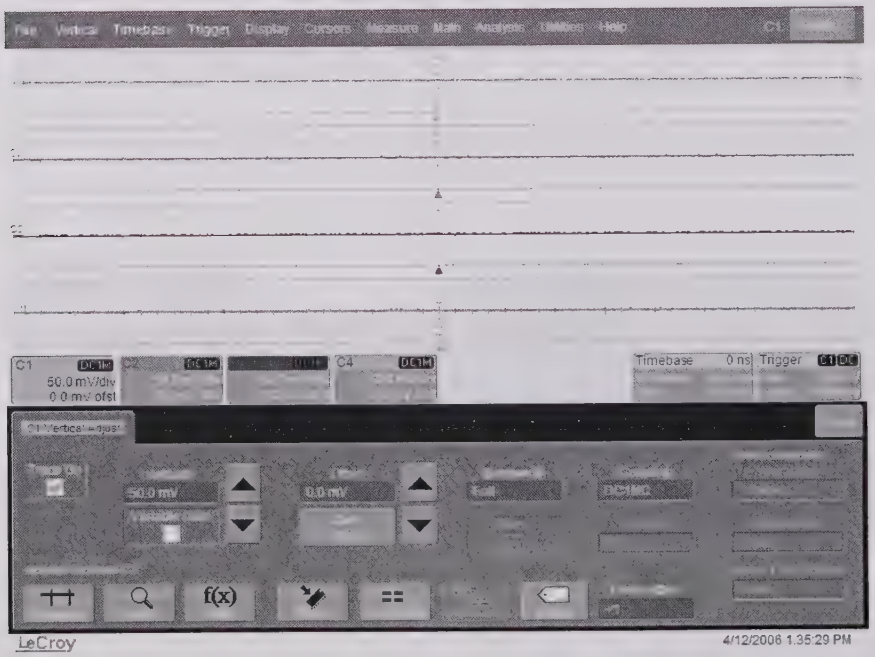


- Set the DMM with **Ohms and Ohms sense** to provide a 4 wire measurement.
- Connect the DMM to Channel 1.
- Measure the **input impedance**, reverse the meter leads and measure the input impedance.
- **Average** these two numbers and record it in Table 2, and compare it to the limits.
- Repeat the above test for all input channels.
- Recall **Input Impedance - 50 ohm x10.lss** or set input gain to **200 mV/div.** on all 4 Channels.
- Repeat the test for all input channels.
- **Record** the measurements in Table 2, and **compare** the test results to the limits in the test record.

b. DC 1MΩ

- Recall **Input Impedance - 1 Mohm x1.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 1 MΩ** on all 4 Channels
Input gain	:	**20 mV/div.** on all 4 Channels
Time base	:	**50 ηsec/div.**
Trigger mode	:	**Auto**



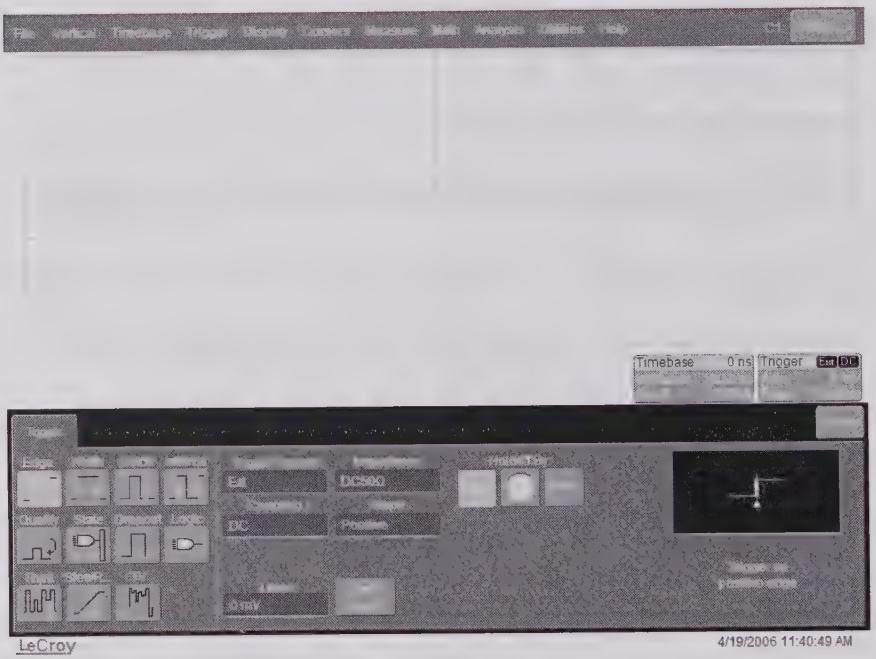
- Set the DMM with **Ohms and Ohms sense** to provide a 4 wire measurement.
- Connect the DMM to Channel 1.
- Measure the **input impedance**, reverse the meter leads and measure the input impedance.
- **Average** these two numbers and **record** it in Table 2, and compare it to the limits.
- Repeat the above test for all input channels.
- Recall **Input Impedance - 1 Mohm x10.lss** or Set Input gain to **200 mV/div.** on all 4 Channels.
- Repeat the test for all input channels.
- **Record** the measurements in Table 2, and compare the test results to the limits in the test record.
- Recall **Input Impedance - 1 Mohm x100.lsss** or Set Input gain to **2 V/div.** on all 4 Channels.
- Repeat the test for all input channels.
- **Record** the measurements in Table 2, and compare the test results to the limits in the test record.

5.4.2 External Trigger Input Impedance

a. DC 50Ω

- Recall **Input Impedance - 50 ohm ext x1.lss** or configure the DSO:

  Select Setup trigger
  Trigger on : **EXT**
  Impedance : **DC 50Ω**



- Connect the DMM to External, and measure the **input impedance**, reverse the meter leads and measure the input impedance.
- **Average** these two numbers and **record** the input impedance in Table 2. **Compare** the result to the limit in the test record.

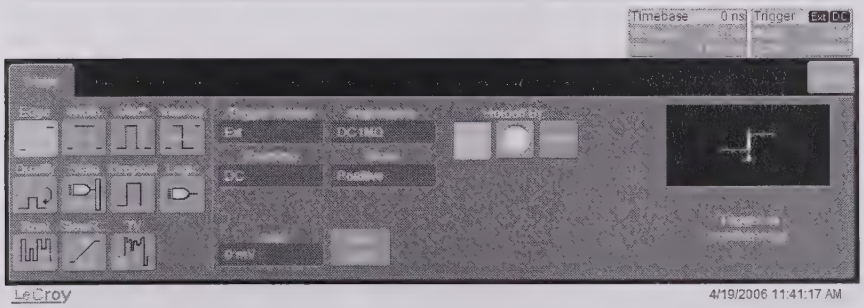
b. Ext DC 1MΩ Input Impedance

- Recall **Input Impedance - 1 Mohm DC Ext x1.lss** or configure the DSO:

  Select Setup trigger

  Trigger on : **EXT**

  Impedance : **DC 1MΩ**



- Connect the DMM to External, and measure the **input impedance**, reverse the meter leads and measure the input impedance.
- **Average** these two numbers and record the input impedance in Table 2, and compare the result to the limit in the test record.

5.5 Leakage Current

Specifications

DC 50Ω, EXT DC 50Ω : ±2 mV
DC/AC 1M, ±2 mV

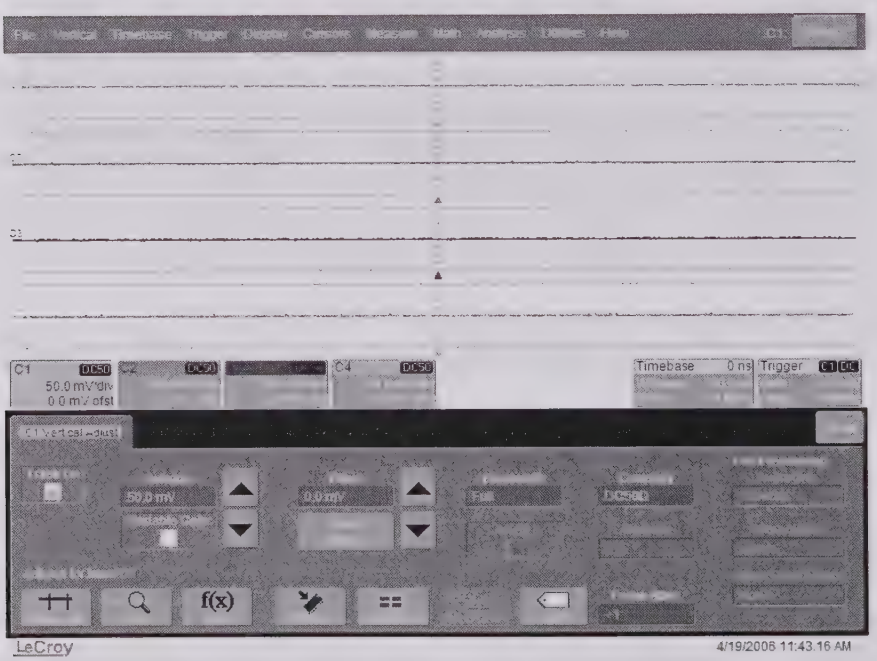
The leakage current is tested by measuring the voltage across the input channel.

5.5.1 Channel Leakage Current

a. DC 50Ω

- Recall **Leakage - 50 ohm x1.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input gain	:	**20 mV/div.** on all 4 Channels
Trigger mode	:	**Auto**
Time base	:	**50 ηsec/div.**



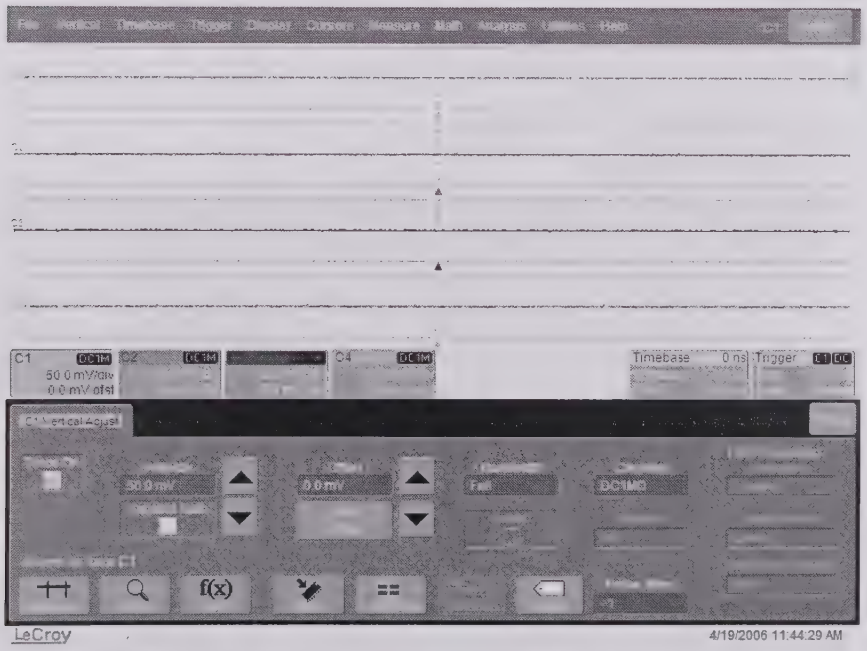
- Set the DMM to measure Volts, and connect it to Channel 1.
- Measure the **voltage** and enter it in Table 3. Compare it to the limits.
- Repeat the test for all input channels.

- Recall **Leakage - 50 ohm x10.lss** or set Input gain to **200 mV/div.** on all 4 Channels
- Repeat the test for all input channels. Record the measurements in Table 3, compare the results to the limits in the test record.

b. DC 1MΩ

- Recall **Leakage - 1 Mohm x1.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 1MΩ** on all 4 Channels
Input gain	:	**20 mV/div.** on all 4 Channels
Trigger mode	:	**Auto**
Time base	:	**50 ηsec/div.**



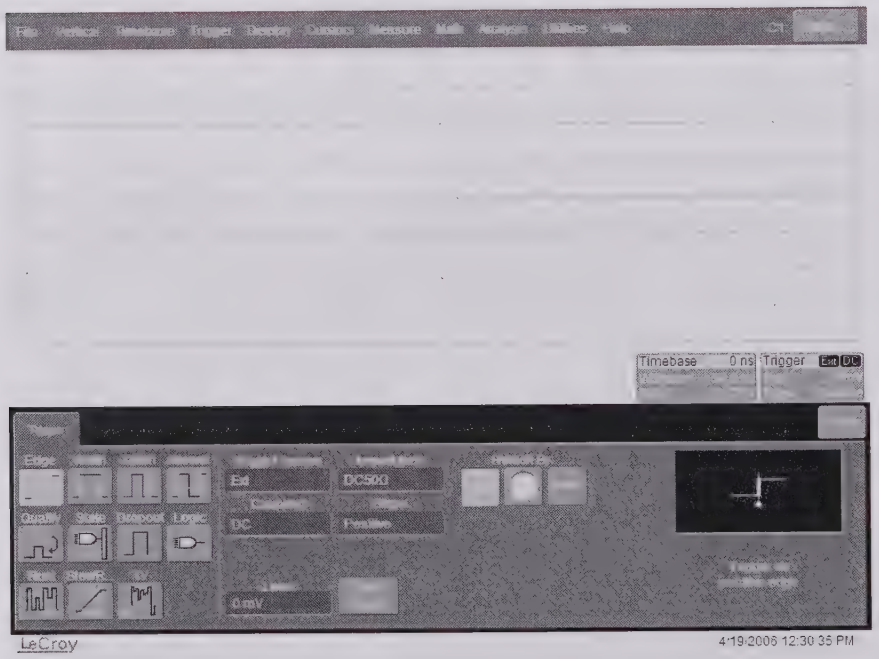
- Set the DMM to measure Volts, and connect it to Channel 1.
- Measure the **voltage** and enter it in Table 3. Compare the result to the limits in the test record.
- Repeat the test for all input channels.
- Recall **Leakage - 1 Mohm x10.lss** or set Input gain to **200 mV/div.** on all 4 Channels
- Repeat the test for all input channels. Record the measurements in Table 3, and compare the results to the limits in the test record.

- Recall **Leakage - 1 Mohm x100.lss** or set Input gain to 2 V/div. on all 4 Channels
- Repeat the test for all input channels. Record the measurements in Table 3, and compare the results to the limits in the test record.
- Recall **Leakage - 1 Mohm AC x1.lss** or set Input gain to **20 mV/div.** on all 4 Channels.
- Repeat the test for all input channels. Record the measurements in Table 3, and compare the results to the limits in the test record.

5.5.2 External Trigger Leakage Current

a. DC 50Ω

- Recall **Leakage - 50 ohm ext x1.lss** or configure the DSO as shown in 5.5.1 and make the following changes:
  Select Setup trigger
  Set Trigger on : **EXT**
  Impedance : **DC 50Ω**



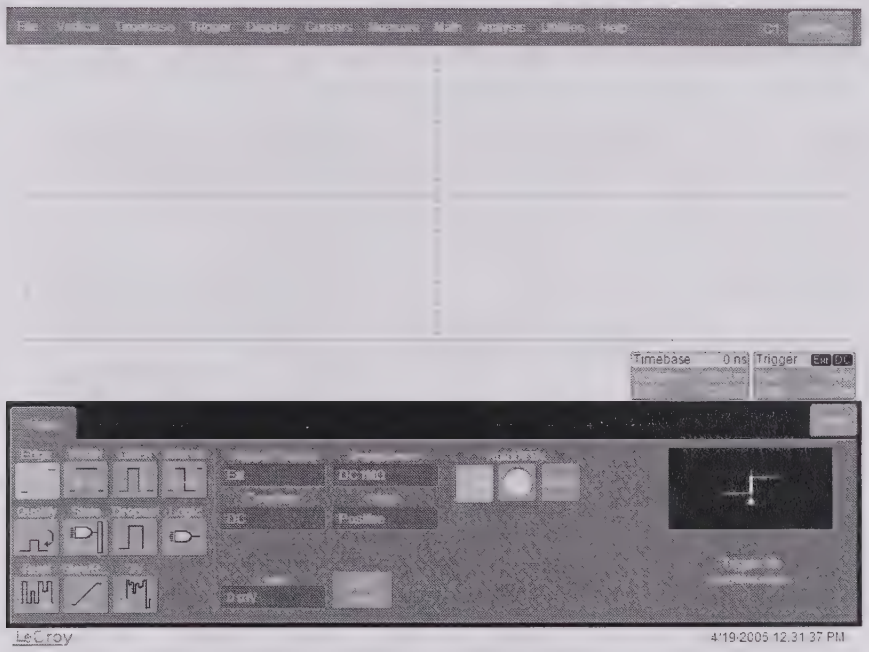
- Connect the DMM to External.
- Measure the voltage and enter it in Table 3. Compare the results to the limits in the test record

b. DC 1MΩ

- Recall **Leakage - 1 Mohm ext x1.lss** or configure the DSO as shown in 5.5.1 and make the following changes:

  Select Setup trigger
  Set Trigger on : **EXT**

  Impedance : **DC 1MΩ**



- Connect the DMM to External.
- Measure the voltage and enter it in Table 3. Compare it to the limits.

5.6 Noise Level

Description

Noise tests with open inputs are executed on all channels with 0 mV offset, at a gain setting listed in the test record. The scope parameters functions are used to measure the Sdev of the noise.

WS6x, 4x, 24Xs Specifications

Signal to Noise ratio:
>28db @ 2mV
>33db @ 5mV
>36db @ ≥10mV

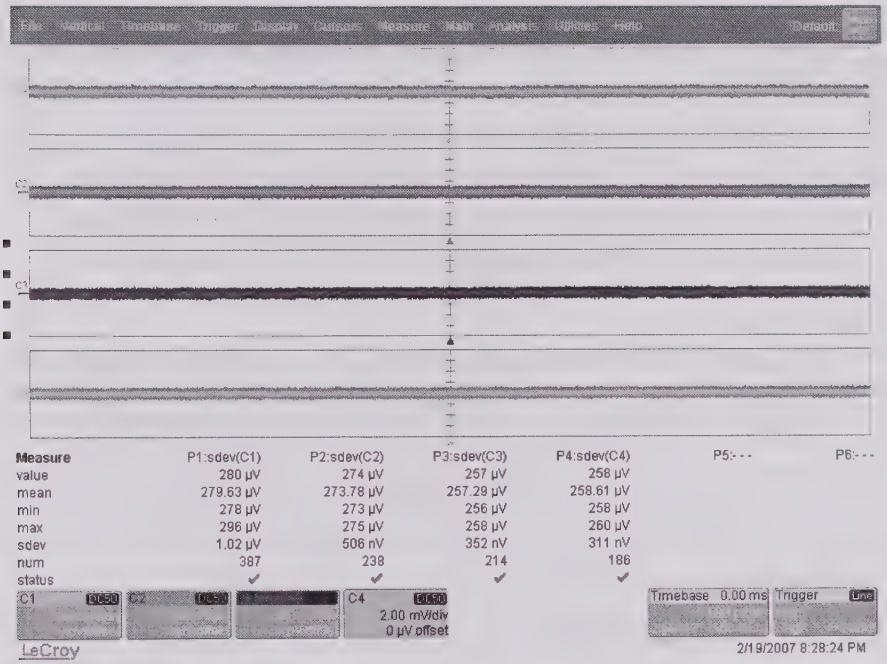
WS104Xs Specifications

Signal to Noise ratio:
>24db @ 2mV
>28db @ 5mV
>31.5db @ 10mV and 100mV
>34.5db @ 20mV, 200Mv and 2V

With no signal connected to the inputs

- Recall **Noise sdev - 2mv.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input gain	:	**2 mV/div.** on all 4 Channels
Input offset	:	**0.0 mV** on all 4 Channels
Trigger setup	:	**Edge**
Trigger on	:	**C1**
Trigger Mode	:	**Auto**
Time base	:	**500 µsec/div.**
Max sample points:		**2.5MS**
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
Press	:	**Measure, Measure Setup,**
Statistics	:	**On**
Add parameters		
P1	:	**Measure sdev of Ch1**
P2	:	**Measure sdev of Ch2**
P3	:	**Measure sdev of Ch3**
P4	:	**Measure sdev of Ch4**


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help Default
Measure P1:sdev(C1) P2:sdev(C2) P3:sdev(C3) P4:sdev(C4) P5:- - - P6:- - -
value 280 µV 274 µV 257 µV 258 µV
mean 279.63 µV 273.78 µV 257.29 µV 258.61 µV
min 278 µV 273 µV 256 µV 258 µV
max 296 µV 275 µV 258 µV 260 µV
sdev 1.02 µV 506 nV 352 nV 311 nV
num 387 238 214 186
status ✔ ✔ ✔ ✔
C1 C2 C4
2.00 mV/div
0 µV offset
Timebase 0.00 ms Trigger
LeCroy
2/19/2007 8:28:24 PM

- Press **Clear Sweeps.**

Measure for at least **20 sweeps**, and then press **Stop** to halt the acquisition.

- Record the four **max sdev** parameter values in Table 4, and compare the test results to the limits in the test record.

- Repeat for all ranges listed in the test record.

- **The WS104Xs tests the 1Mohm inputs also. Recall Noise sdev 1Mohm - 2mv.lss (or configure the DSO manually) when testing this input couping. Record the results in Table 5.**

5.7 DC Accuracy

Specification: In all cases the offset is 0mV.

2mV/div = ≤ ±3.5 % of reading + 1.0% of FS + 1mV full scale

5mV/div = ≤ ±3.0 % of reading + 1.0% of FS + 1mV full scale

10mV/div = ≤ ±1.5 % of reading + 1.0% of FS + 1mV full scale

Description

This test measures the absolute voltage DC Accuracy within the gain range specified.
It requires a DC source with a voltage range of 0 V to 6 V adjustable in steps of no more than 15 mV and a calibrated DMM that can measure voltage to 0.1 %.
Measurements are made using voltage values applied by the external voltage reference source, measured by the DMM, and in the oscilloscope using the parameter Mean. For each known input voltage, the deviation is checked against the tolerance.

5.7.1 Positive 50Ω DC Accuracy

Procedure

- Recall **DC accuracy - 50 ohm 2mv.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input offset	:	**0.0 mV** on all 4 Channels
Input gain	:	from **2mV/div to 1 V/div.** (see Table 6) on all 4 Ch
BW limit	:	**200 MHz**
C1 Averaging	:	**1 sweeps**
C2 Averaging	:	**1 sweeps**
C3 Averaging	:	**1 sweeps**
C4 Averaging	:	**1 sweeps**
Trigger setup	:	**Edge**
Trigger on	:	**Line**
Mode	:	**Auto**
Time base	:	**1 µsec/div**.
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
Change parameters		
P1	:	**Measure mean of C1**
P2	:	**Measure mean of C2**
P3	:	**Measure mean of C3**
P4	:	**Measure mean of C4**

The following test setups are a suggested setup which will work with power supplies which do not have enough resolution in their set points or are noisy at low voltages. If you are using a precision DC calibrator you need not use 20db attenuators as shown in Fig 5-1 or 5-2 and can use the setup of figure 5-3.

- For the low sensitivities: **2 mV - 5 mV/div**., connect the test equipment as shown in Figure 5-1.

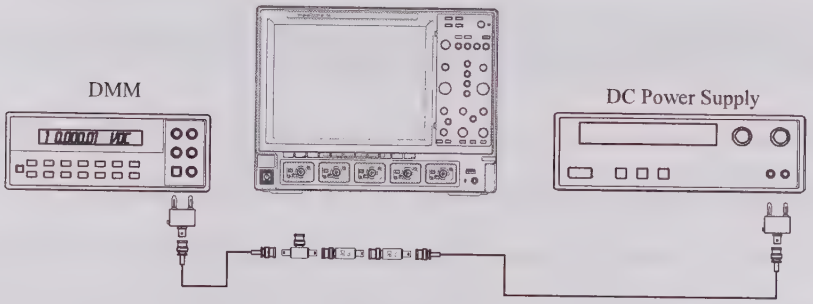


Figure 5-1 : DC 50Ω Accuracy Equipment Setup for 2 mV - 5 mV/div

- For the sensitivities: **10 mV** and **50 mV/div**, connect the test equipment as shown in Figure 5-2.

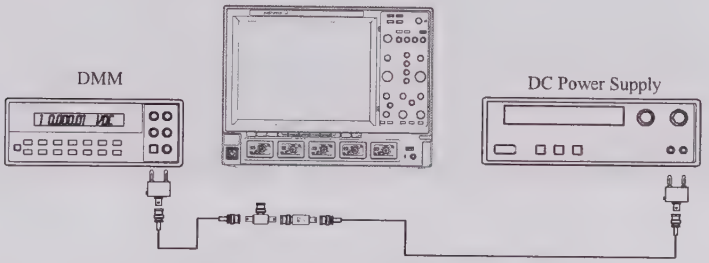


Figure 5-2 : DC 50Ω Accuracy Equipment Setup for 10 mV and 50 mV/div

- For the range **100 mV**, **200mV**, **500 mV** and **1 V/div** no attenuator is required, connect the test equipment as shown in Figure 5-3.

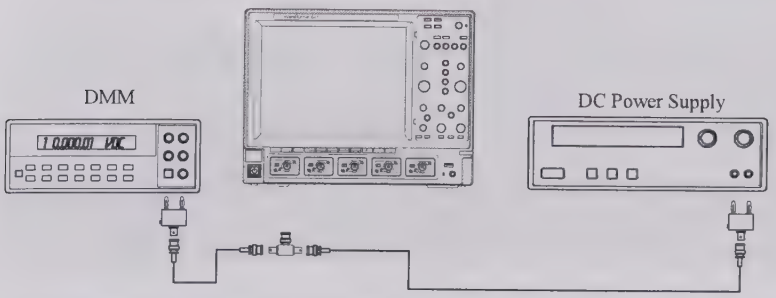


Figure 5-3 : DC 50Ω Accuracy Equipment Setup for 100 mV - 1 V/div.

▪ For each **DSO Volts/div**, set the output of the external **DC voltage reference source** as shown in Table 6, column **PS output**.

1) Connect the DMM and record the **voltage reading** in Table 6, column **DMM.**

2) Disconnect the DMM from the BNC T connector.

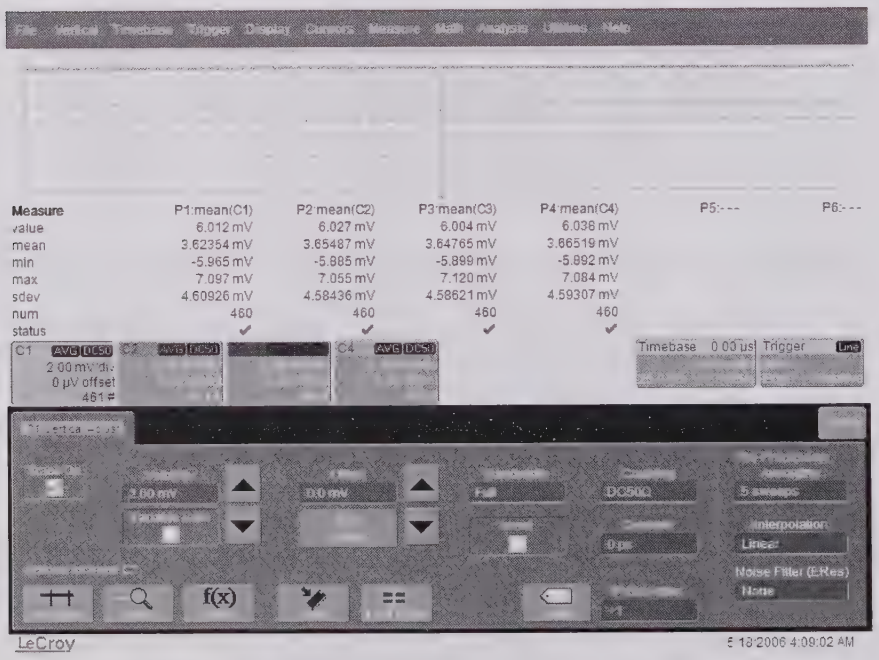
3) Press (Auto Trigger) and **Clear Sweeps**

4) After 100 sweeps **PRESS STOP**. Read off the **DSO mean parameter** and record the measurement in Table 6, column **Mean**.

5) Moving the DC input, repeat step 3 and 4 for each channel.

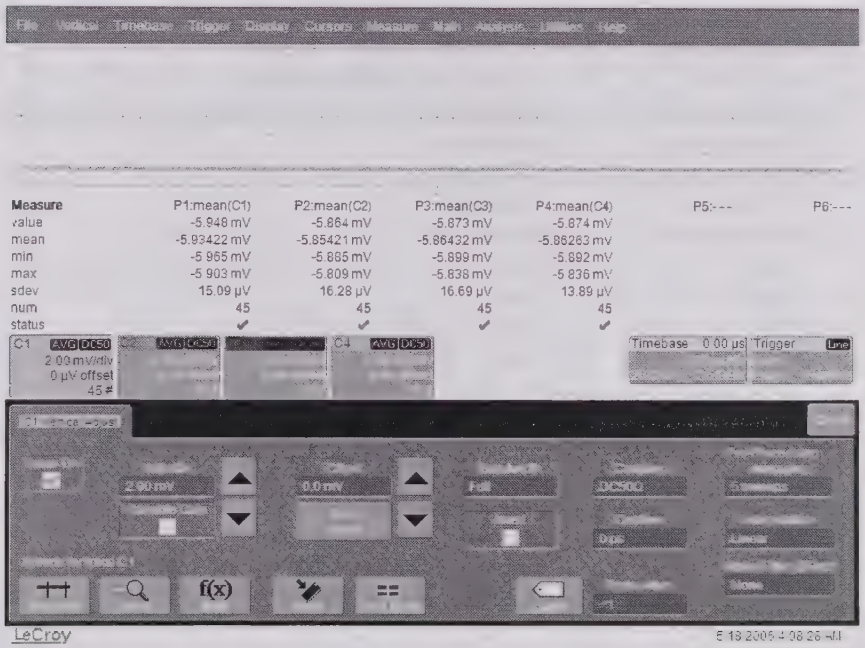
- For each DC voltage applied to the DSO input, repeat parts 1, 2), 3), 4) and 5).

- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading. Record the test result in Table 6, and compare the **Difference (Δ)** to the corresponding limit in the test record.



5.7.2 Negative 50Ω DC Accuracy

- Recall **DC accuracy - 50 ohm 2mv.lss** or configure the DSO as shown in 5.7.1.
- Connect the test equipment as shown in either Figure 5-1 or 5-2 or 5-3.
- For each **DSO Volts/div**, set the output of the external **DC voltage reference source** as shown in Table 7, column PS output. (if a banana-BNC adapter is being used it can simply be turned to get the opposite polarity)



1) Connect the DMM and record the **voltage reading** in Table 7, column **DMM.**
2) Disconnect the DMM from the BNC T connector.
3) Press **Clear Sweeps**
6) After 100 sweeps(# readout in CH descriptor box) **PRESS STOP** and read off the **DSO mean parameter**, and record the measurement in Table 6, column **Mean**.

- For each DC voltage applied to the DSO input, repeat parts 1), 2), 3) and 4).
- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading. Record the test result in Table 7, and compare the **Difference (Δ)** to the corresponding limit in the test record.
- Repeat step 5.7.2. for the other channels, substituting channel controls and input connector.

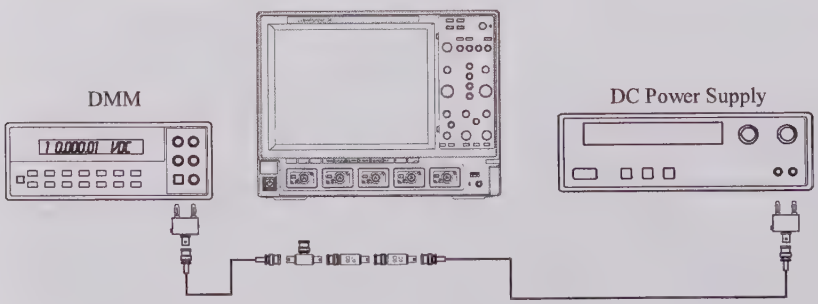
5.7.1 Positive 1MΩ DC Accuracy

Procedure

- Recall **DC accuracy - 1 Mohm 2mv.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 1MΩ** on all 4 Channels
Input offset	:	**0.0 mV** on all 4 Channels
Input gain	:	from **2mV/div to 1 V/div.** (see Table 8) on all 4 Ch
C1 Averaging	:	**1 sweeps**
C2 Averaging	:	**1 sweeps**
C3 Averaging	:	**1sweeps**
C4 Averaging	:	**1 sweeps**
Trigger setup	:	**Edge**
Trigger on	:	**Line**
Mode	:	**Auto**
Time base	:	**1 µsec/div**.
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
Change parameters		
P1	:	**Measure mean of C1**
P2	:	**Measure mean of C2**
P3	:	**Measure mean of C3**
P4	:	**Measure mean of C4**

The following test setups are a suggested setup which will work with power supplies which do not have enough resolution in their set points. If you have a power supply with enough resolution you need not use 20db attenuators as shown in Fig5-4 or 5-5 and can use the setup of figure 5-6.



- For the low sensitivities: **2 mV through 10 mV/div**., connect the test equipment as shown in Figure 5-4.

Figure 5-4 : DC 1MΩ Accuracy Equipment Setup for 2 mV - 10 mV/div

- For the sensitivities: **50 mV** and **100 mV/div**, connect the test equipment as shown in Figure 5-5.

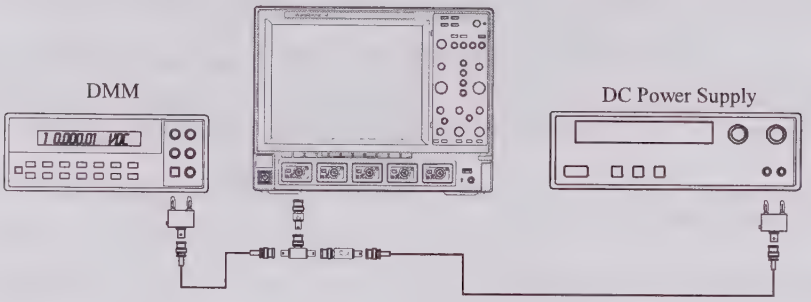


Figure 5-5 : DC 1MΩ Accuracy Equipment Setup for 50 mV and 100 mV/div

- For the range **200 mV**, - **1 V/div** no attenuator is required, connect the test equipment as shown in Figure 5-6.

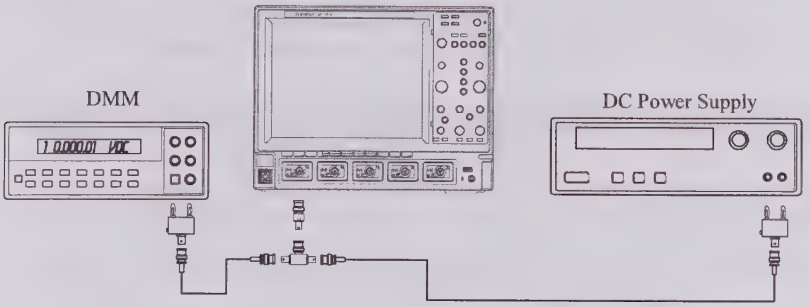


Figure 5-6 : DC 1MΩ Accuracy Equipment Setup for 200 mV and 1 V/div.

- For each **DSO Volts/div**, set the output of the external **DC voltage reference source** as shown in Table 7, column **PS output**.

  1) Connect the DMM and record the **voltage reading** in Table 8, column **DMM.**

  2) Disconnect the DMM from the BNC T connector.

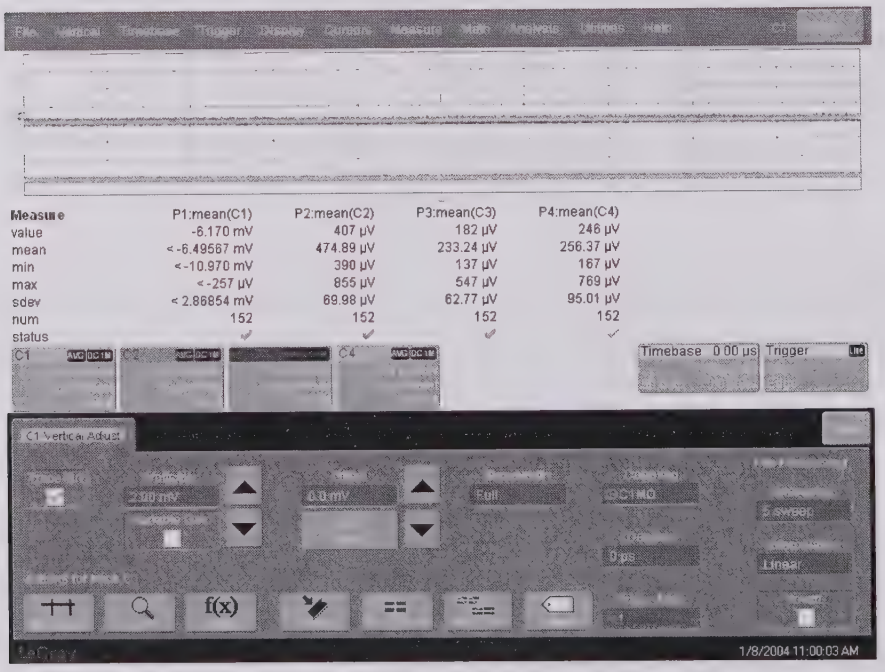
  3) Press **Clear Sweeps**

  4) After 100 sweeps, read off the **DSO mean parameter**, and record the measurement in Table 8, column **Mean**.

- For each DC voltage applied to the DSO input, repeat parts 1), 2), 3) and 4).
- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading. Record the test result in Table 8, and compare the **Difference (Δ)** to the corresponding limit in the test record.
- Repeat step 5.7.1.a. for the other channels, substituting channel controls and Input connector.

5.7.2 Negative 1MΩ DC Accuracy

- Recall **DC accuracy - 1 Mohm 2mv.lss** or configure the DSO as shown in 5.7.1.
- Connect the test equipment as shown in either Figure 5-4 or 5-5 or 5-6.
- For each **DSO Volts/div**, set the output of the external **DC voltage reference source** as shown in Table 9, column PS output. (if a banana-BNC adapter is being used it can simply be turned to get the opposite polarity)


Measure P1:mean(C1) P2:mean(C2) P3:mean(C3) P4:mean(C4)
value -6.170 mV 407 µV 182 µV 246 µV
mean <-6.49567 mV 474.89 µV 233.24 µV 256.37 µV
min <-10.970 mV 390 µV 137 µV 167 µV
max <-257 µV 855 µV 547 µV 769 µV
sdev <2.86854 mV 69.98 µV 62.77 µV 95.01 µV
num 152 152 152 152
status
Timebase 0.00 µs Trigger
C1 Vertical Adjust
1/8/2004 11:00:03 AM

1) Connect the DMM and record the **voltage reading** in Table 8, column **DMM.**
2) Disconnect the DMM from the BNC T connector.
3) Press **Clear Sweeps**

4) After 100 sweeps, read off the **DSO mean parameter**, and record the measurement in Table 9, column **Mean**.

- For each DC voltage applied to the DSO input, repeat parts 1), 2), 3) and 4).

- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading. Record the test result in Table 8, and compare the **Difference (Δ)** to the corresponding limit in the test record.

- Repeat step 5.7.2. for the other channels, substituting channel controls and input connector.

5.8 Offset Accuracy

Specifications

±(1.5% of offset + 0.5% of FS + 1mv) for 24/4x/6xXs models
±(1.5% of offset + 1.0% of FS + 1mv) for 104Xs model

Description

The offset test is done at 50 mV/div, with a signal of ±0.750 Volt cancelled by an offset of the opposite polarity.

5.8.1 Positive 50Ω Offset Accuracy

Procedure

- Recall **Offset - 50 ohm Positive.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input gain	:	**50mV/div** on all 4 Channels
Input offset	:	**+0.750 Volt** on all 4 Channels
C1 Averaging	:	**5 sweeps**
C2 Averaging	:	**5 sweeps**
C3 Averaging	:	**5 sweeps**
C4 Averaging	:	**5 sweeps**
Trigger setup	:	**Edge**
Trigger on	:	**Line**
Mode	:	**Auto**
Time base	:	**50 ηsec/div**.
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
Statistics	:	**on**
Change parameters		
P1	:	**Measure mean of C1**
P2	:	**Measure mean of C2**
P3	:	**Measure mean of C3**
P4	:	**Measure mean of C4**

- Connect the test equipment as shown in Figure 5-7.

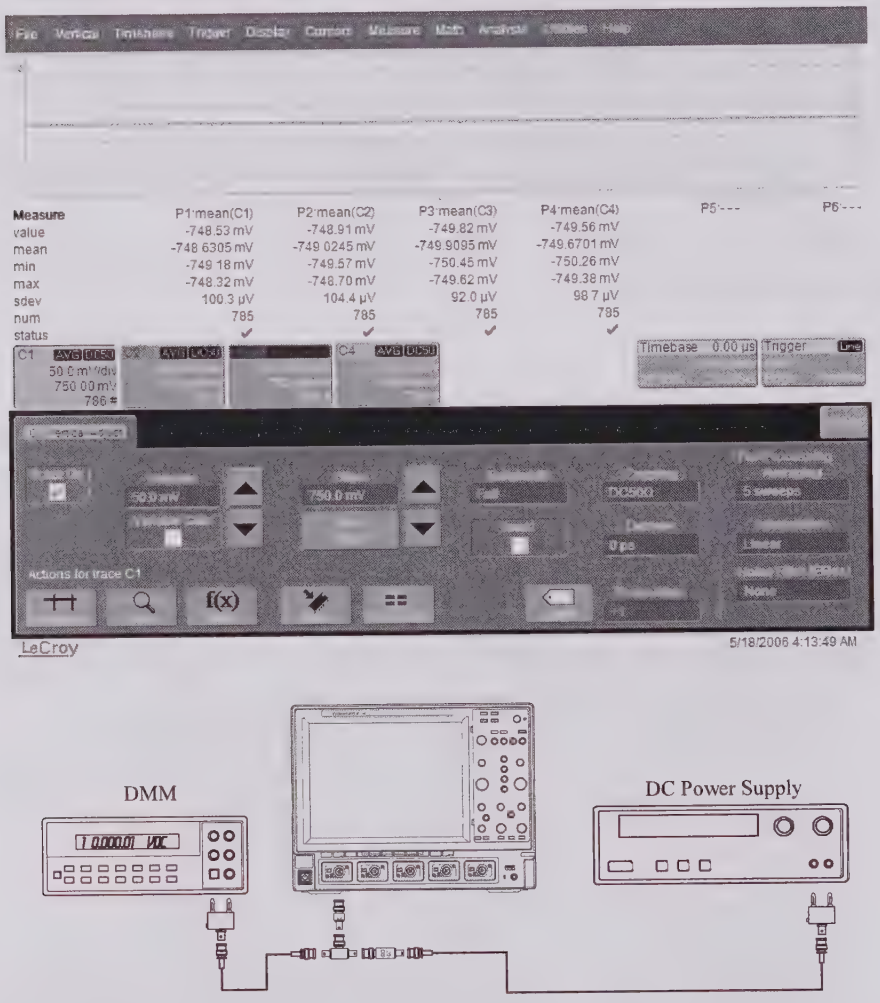


Figure 5-7 : Offset Accuracy Equipment Setup

- Set the output of the external **DC voltage reference source until the DVM measures –0.750 Volt.**

  1) Verify that the displayed trace A : Average (1) is on the screen, near the center horizontal graticule line. If the trace is not visible, modify the **DC voltage reference source output** until the trace is within ± 2 divisions of center.

  2) Connect the DMM and record the **voltage reading** in Table10, column **DMM**.

  3) Disconnect the DMM from the BNC T connector.

4) Press **Clear Sweeps**

5) After 100 sweeps, Read off the DSO Mean parameter voltage, and record the measurement in Table 10, column Mean.

- Repeat the test for the other channels, substituting channel controls and input connector. Record the measurements in Table 9.

- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading.

- Record the test result in Table 10, and compare the **Difference (Δ)** to the corresponding limit in the test record.

5.8.2 Negative 50Ω Offset Accuracy

Procedure

- Recall **Offset - 50 ohm Negative.lss** or configure the DSO as shown in 5.8.1 and for each channel make the following change :

  Input offset : **–0.750 Volt** on all 4 Channels

- Connect the test equipment as shown in Figure 5-7.

- Set the output of the external **DC voltage** reference source until the DMM measures +0.750 Volt.

  1) Verify that the displayed trace A : Average (1) is on the screen, near the center horizontal graticule line. If the trace is not visible, modify the **DC voltage reference source output** until the trace is within ± 2 divisions of center.

  2) Connect the DMM and record the **voltage reading** in Table 11, column **DMM**.

  3) Disconnect the DMM from the BNC T connector.

  4) Press **Clear Sweeps**

  5) After 100 sweeps, Read off the **DSO Mean parameter** voltage, and record the measurement in Table 11, column **Mean**.

- Repeat the test for the other channels, substituting channel controls and input connector. Record the measurements in Table 11.

- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading. Record the test result in Table 11, and compare the **Difference (Δ)** to the corresponding limit in the test record.

5.8.3 Positive 1MΩ Offset Accuracy

Procedure

- Recall **Offset - 1 Mohm Positive.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 1MΩ** on all 4 Channels
Input gain	:	**50mV/div** on all 4 Channels
Input offset	:	**+0.750 Volt** on all 4 Channels
C1 Averaging	:	**5 sweeps**
C2 Averaging	:	**5 sweeps**
C3 Averaging	:	**5 sweeps**
C4 Averaging	:	**5 sweeps**
Trigger setup	:	**Edge**
Trigger on	:	**Line**
Mode	:	**Auto**
Time base	:	**50 ηsec/div**.
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
Statistics	:	**on**
Change parameters		
P1	:	**Measure mean of C1**
P2	:	**Measure mean of C2**
P3	:	**Measure mean of C3**
P4	:	**Measure mean of C4**

- Connect the test equipment as shown in Figure 5-7.

- Set the output of the external **DC voltage reference source until the DVM measures –0.750 Volt.**

  1) Verify that the displayed trace A : Average (1) is on the screen, near the center horizontal graticule line. If the trace is not visible, modify the **DC voltage reference source output** until the trace is within ± 2 divisions of center.

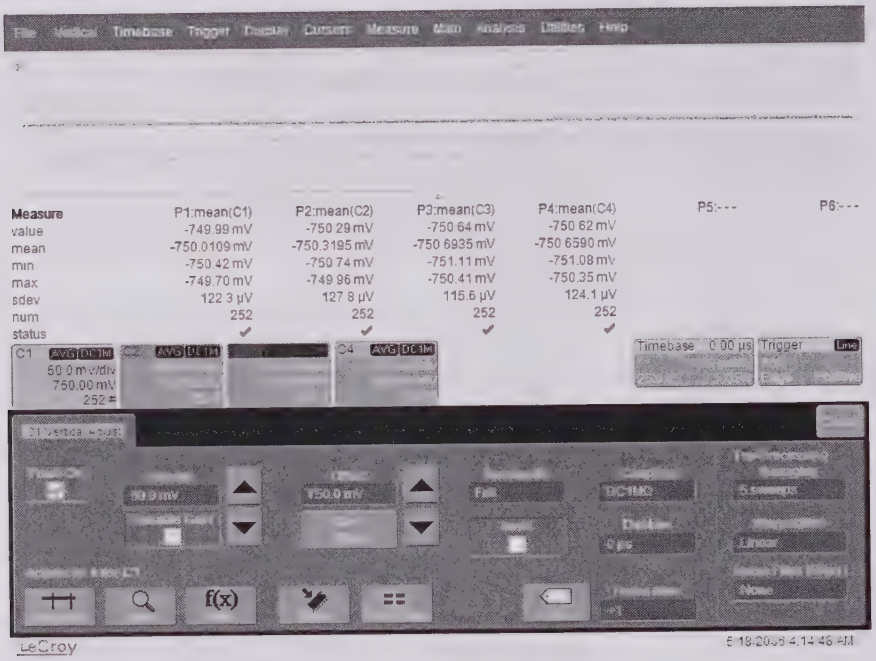
  2) Connect the DMM and record the **voltage reading** in Table 12, column **DMM**.

  3) Disconnect the DMM from the BNC T connector.

  4) Press **Clear Sweeps**

  5) After 100 sweeps, Read off the DSO Mean parameter voltage, and record the measurement in Table 12, column Mean.

- Repeat the test for the other channels, substituting channel controls and input connector. Record the measurements in Table 12.


Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
Measure P1:mean(C1) P2:mean(C2) P3:mean(C3) P4:mean(C4) P5:--- P6:---
value -749.99 mV -750.29 mV -750.64 mV -750.62 mV
mean -750.0109 mV -750.3195 mV -750.6935 mV -750.6590 mV
min -750.42 mV -750.74 mV -751.11 mV -751.08 mV
max -749.70 mV -749.96 mV -750.41 mV -750.35 mV
sdev 122.3 µV 127.8 µV 115.6 µV 124.1 µV
num 252 252 252 252
status
C1 AVG DC 1M
50.0 mV/div
750.00 mV
252
C2 AVG DC 1M
C4 AVG DC 1M
Timebase 0.00 µs
Trigger
LeCroy

- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading.

- Record the test result in Table 12, and compare the **Difference (Δ)** to the corresponding limit in the test record.

5.8.4 Negative 1MΩ Offset Accuracy

Procedure

- Recall **Offset - 1 Mohm Negative.lss** or configure the DSO as shown in 5.8.1 and for each channel make the following change :

  Input offset : **–0.750 Volt** on all 4 Channels

- Connect the test equipment as shown in Figure 5-7.

- Set the output of the external **DC voltage** reference source until the DMM measures +0.750 Volt.

  1) Verify that the displayed trace A : Average (1) is on the screen, near the center horizontal graticule line. If the trace is not visible, modify the **DC voltage reference source output** until the trace is within ± 2 divisions of center.

2) Connect the DMM and record the **voltage reading** in Table 13, column **DMM**.

3) Disconnect the DMM from the BNC T connector.

4) Press **Clear Sweeps**

5) After 100 sweeps, Read off the **DSO Mean parameter** voltage, and record the measurement in Table 13, column **Mean**.

- Repeat the test for the other channels, substituting channel controls and input connector. Record the measurements in Table 13.
- Calculate the **Difference (Δ)** by subtracting the **DMM voltage** reading from the **DSO mean** voltage reading. Record the test result in Table 13, and compare the **Difference (Δ)** to the corresponding limit in the test record.

5.9 Bandwidth

5.9.1 Description

The purpose of this test is to ensure that the entire system has a bandwidth of at least 600 MHz for a WaveSurfer 64Xs & 62Xs, and 400 MHz for a WaveSurfer 44Xs and 42Xs, and 200 MHz for the 24Xs and 1000 MHz for the WaveSurfer104Xs. An external source is used as the reference to provide a signal where amplitude and frequency are well controlled.
The amplitude of the generator and cable as a function of frequency and power is calibrated using an HP8482A sensor on an HP437B power meter or equivalent. Note: If a leveled generator is used then the corrections needed by using the power meter may not be necessary.

Specifications

WaveSurfer - 64Xs or 62Xs
50Ω : DC to at least 600 MHz (-3 dB)

WaveSurfer - 44Xs or 42Xs
50Ω : DC to at least 400 MHz (-3 dB)

WaveSurfer - 24Xs
50Ω : DC to at least 200 MHz (-3 dB)

WaveSurfer - 104Xs
50Ω : DC to at least 1000 MHz (-3 dB)

- Recall **Bandwidth - CH1 10mv.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input gain	:	**10 mV/div** on all 4 Channels
Input offset	:	**0 mV** on all 4 Channels
Trigger setup	:	**Edge**
Trigger on	:	**Line**
Slope line	:	**Pos**
Mode	:	**Auto**
Time base	:	**50 ηsec/div**.
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
Max Sample points:		**500 kS**
Change parameters		
P1	:	**Sdev of C1**
P2	:	**Freq of C1**

- Connect the HP8482A power sensor to the power meter.
- Zero and **calibrate** the HP8482A power sensor using the power meter **Power Ref output**.
- Connect a **BNC adapter** to the HP8482A power sensor.
- Connect a 50Ω SMA cable to the **RF output** of the HP8648B/C generator and then through the necessary adapters to the power sensor. It is very important that the same cable/generator be used throughout this BW procedure and that the SMA connectors are torqued at all their mating locations.

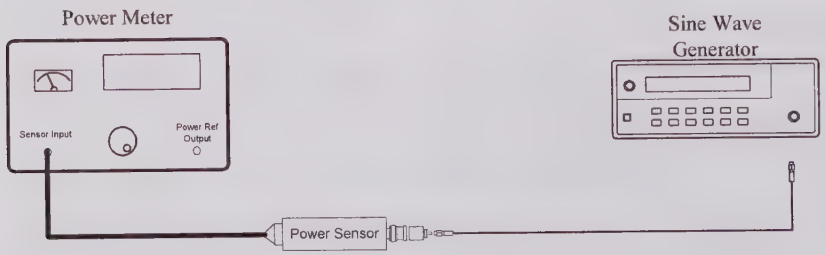


Figure 5-8 : Power Meter Equipment Setup

- Set the generator frequency to **10 MHz**
- Set the generator amplitude to measure **8 µW** on the power meter.

- Read the displayed **generator output amplitude,** and record it as generator amplitude in the 10MHz section in table 14,10 mV/div bandwidth Test Record

- Repeat the above measurement for the appropriate scope model, **200.1 MHz, 400.1 MHz, 600.1 MHz & 1000.1 MHz** as well as for different V/div settings. Record the generator output amplitude readouts in the fourth column of Table 14.

- Disconnect the **RF output** of the HP8648B/C generator from the power sensor.

- Connect the **RF output** of the HP8648B/C generator through the same cable that was calibrated in the previous step into Channel 1.

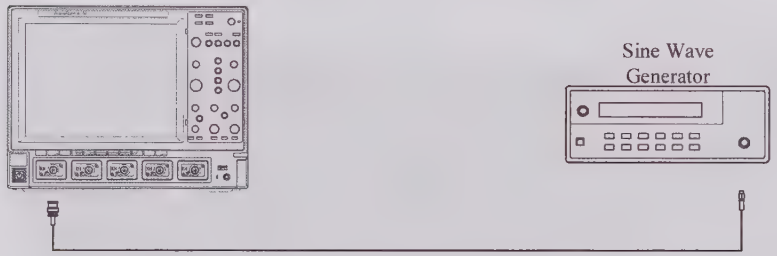


Figure 5-9 : 50Ω Bandwidth Equipment Setup

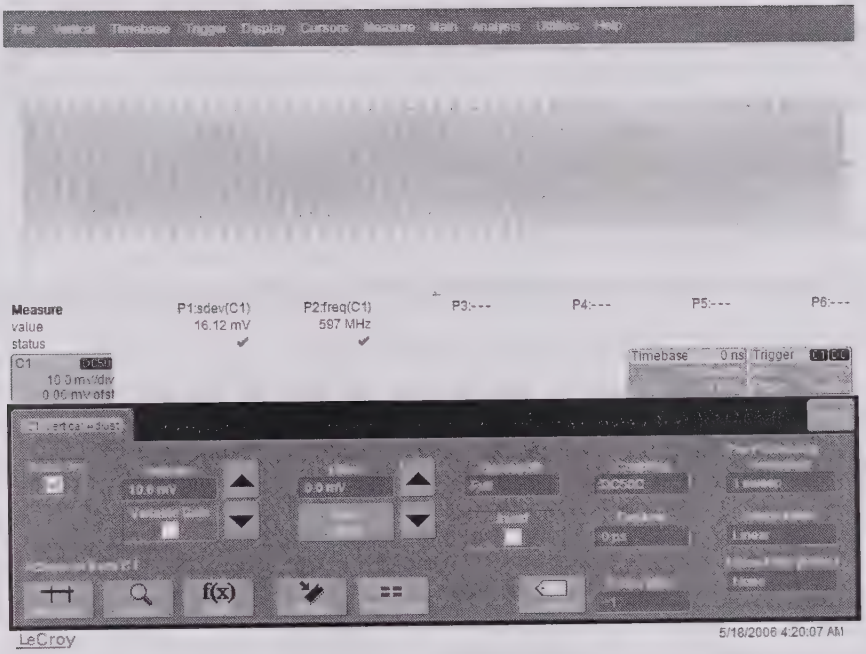
- Set the generator frequency to **10 MHz**.

- From the generator, apply the **recorded generator signal amplitude** to the Channel 1 input connector.

- Measure the value of **Sdev(1)** in Table 14.

- Increase the frequency of the generator to the maximum bandwidth of the scope model under test. Apply the **recorded generator signal amplitude** so the power remains constant, and record the Sdev value for channel 1 in table14.

- Repeat the above 3 steps for Channel 2, (**Bandwidth – CH2 10mv.lss**) 3 (**Bandwidth – CH3 10mv.lss**) & 4 (**Bandwidth – CH4 10mv.lss**) substituting channel controls and input connector. Record the measurements in Table 14.



- Calculate the ratio to 10 MHz for each channel, $sdev_{600.1}/sdev_{10}$ (for WaveSurfer 64Xs or 62Xs), $sdev_{400.1}/sdev_{10}$ (for WaveSurfer 44Xs or 42Xs), $sdev_{200.1}/sdev_{10}$ (for WaveSurfer 24Xs) and $sdev_{1000.1}/sdev_{10}$ (for WaveSurfer 104Xs) compare the results to the limits in the test record.

- Repeat the above steps for V/div setting of 50 mV, 100 mV, and 500mV, using the appropriate **Bandwidth - CHx yymv.lss** (where x is channel and yy is V/div setting) panel setup and recording your results in Tables 15 through 17. Use the power setting and attenuators as shown in the tables.

5.10 Trigger Level

Specifications

+/- (4% of Full Scale + 2mV)

5.10.1 Description

The trigger capabilities are tested for several cases of the standard edge trigger:

- Channel (internal), and External Trigger sources
- Three DC levels: –2.5, 0, +2.5 major screen divisions
- Positive and negative slopes

5.10.2 Channel Trigger at 0 Division Threshold

- Recall **Trigger - CH1 0 div pos slope.lss** or configure the DSO:

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels Trace ON		**Channel 1, Channel 2, Channel 3 & Channel 4**
Input Coupling	:	**DC 50Ω** on all 4 Channels
Input gain	:	**100 mV/div.** on all 4 Channels
Input offset	:	**0 mV** on all 4 Channels (use show status to verify)
Trigger setup	:	**Edge**
Trigger on	:	**C1**
Slope 1	:	**Pos**
Mode	:	**Auto**
Set Trigger level	:	**DC 0.0 mV**
Pre-Trigger Delay	:	**50 %**
Time base	:	**10 µsec/div.**
Active Channels	:	**4 (2 for 2 channel scope)**
Sampling mode	:	**Real Time**
C1 Pre-Processing:		**Averaging 10 sweeps**
C2 Pre-Processing:		**Averaging 10 sweeps**
C3 Pre-Processing:		**Averaging 10 sweeps**
C4 Pre-Processing:		**Averaging 10 sweeps**

- Set the output of the sine wave generator to **10 KHz.**
- Connect the output of the generator to Channel 1 through a 50 Ohm coaxial cable as shown in Figure 5-10 and adjust the sine wave output amplitude to get **90% of full scale.**

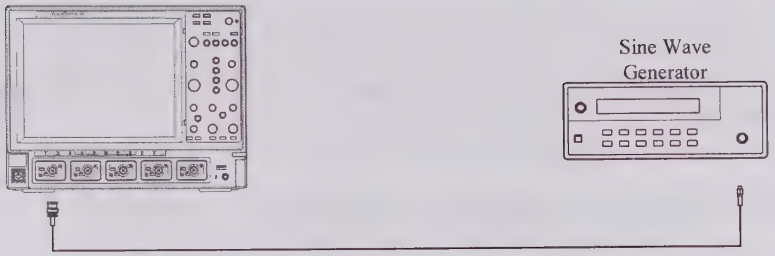
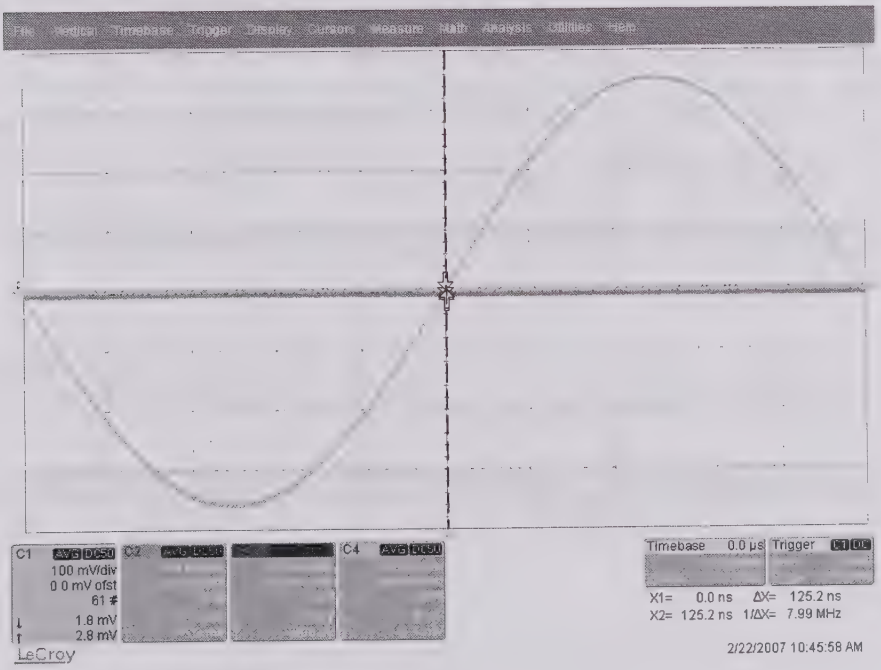


Figure 5-10 Channel Trigger Equipment Setup

- Select Measure: **Cursors, Horizontal Time**
- If needed use the "cursor position" knob, to move the **Time marker** at 0.0us


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
C1 100 mV/div 0.0 mV ofst 61 # 1.8 mV 2.8 mV
C2
C4
Timebase 0.0 µs Trigger
X1= 0.0 ns ΔX= 125.2 ns
X2= 125.2 ns 1/ΔX= 7.99 MHz
2/22/2007 10:45:58 AM
LeCroy

- Press **Clear Sweeps**,

- Acquire 10 sweeps and record in Table 18 the **mean of Horizontal Time cursors** (average the two cursor values) displayed at the bottom of the trace descriptor box, to the bottom left of the grid

- Compare the test results to the corresponding limit in the test record. Set Trigger Slope 1 : **Neg**

- Acquire 10 sweeps and record in Table 18 the **mean of Horizontal Time cursors** (average the two cursor values) displayed at the bottom of the trace descriptor box, to the bottom left of the grid

- Set trigger to channels 2, 3 and 4 and for both POS and NEG slope, move input

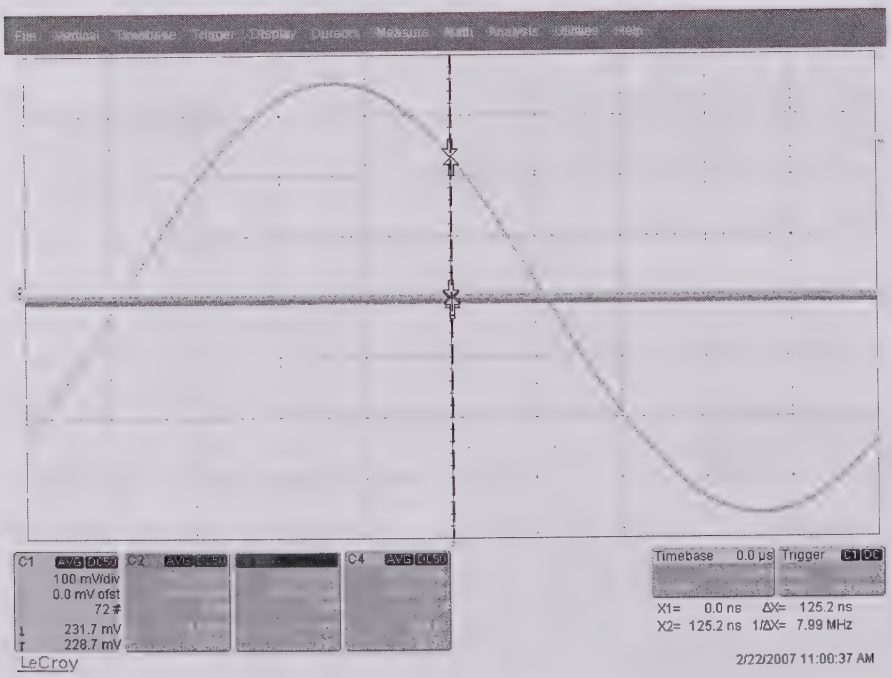
signal to appropriate channel and compare the test results to the corresponding limit in the test record.

5.10.3 Channel Trigger at +2.5 Divisions Threshold

- Recall **Trigger - CH1 +2.5 div pos slope.lss** or configure the DSO as shown in 5.10.2 and for each Channel make the following change :

  Set Trigger level : **DC +250 mV**

- Connect the output of the generator to Channel 1 through a 50 Ohm coaxial cable.
- Press **Clear Sweeps**,
- Acquire 10 sweeps and record in Table 18 the **mean of Horizontal Time cursors** (average the two cursor values) displayed at the bottom of the trace descriptor box, to the bottom left of the grid
- Compare the test results to the corresponding limit in the test record.
- Set Trigger Slope 1 : **Neg**
- Acquire 10 sweeps and record in Table 18 the **mean of Horizontal Time cursors** (average the two cursor values) displayed at the bottom of the trace descriptor box, to the bottom left of the grid



- Set trigger to channels 2, 3 and 4 and for both POS and NEG slope move input signal to appropriate channel and compare the test results to the corresponding limit in the test record.

5.10.4 Channel Trigger at –2.5 Divisions Threshold

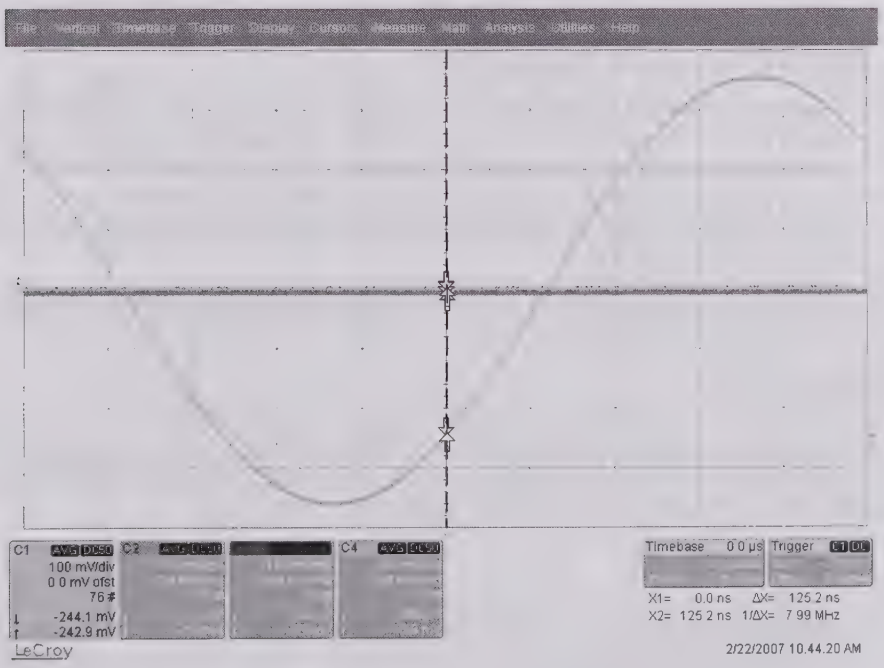
- Recall **Trigger - CH1 -2.5 div pos slope.lss** or configure the DSO as shown in 5.10.2 and for each channel make the following change :

  Set Trigger level : **DC –250 mV**
- Connect the output of the generator to Channel 1 through a 50 Ohm coaxial cable.

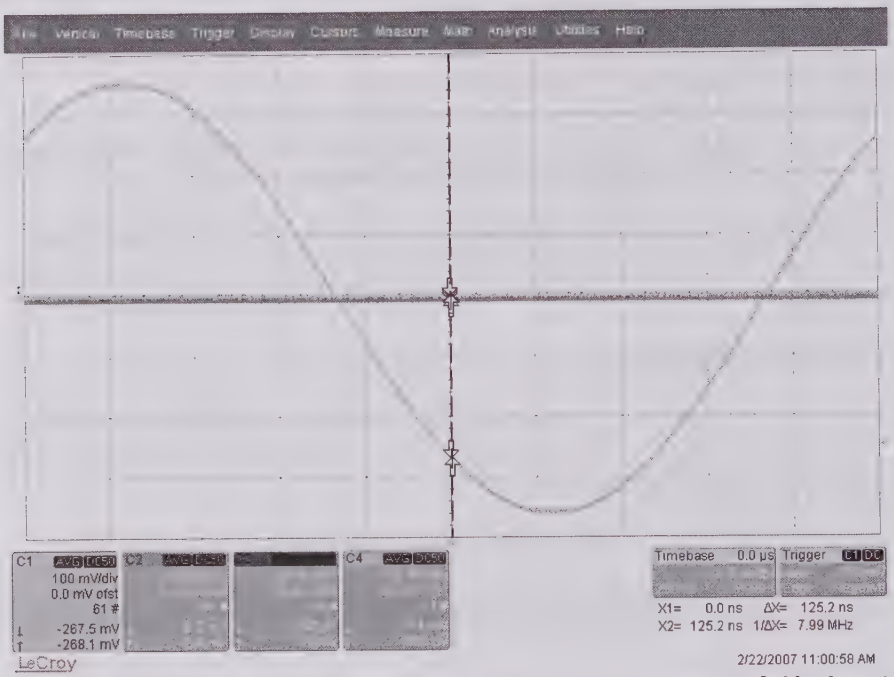
- Press **Clear Sweeps**,

- Acquire 10 sweeps and record in Table 18 the **mean of Horizontal Time cursors** (average the two cursor values) displayed at the bottom of the trace descriptor box, to the bottom left of the grid

- Compare the test results to the corresponding limit in the test record.



- Set Trigger Slope 1 : **Neg**



- Acquire 10 sweeps and record in Table 18 the **mean of Horizontal Time cursors** (average the two cursor values) displayed at the bottom of the trace descriptor box, to the bottom left of the grid
- Set trigger to channels 2, 3 and 4 and for both POS and NEG slope move input signal to appropriate channel and compare the test results to the corresponding limit in the test record.

5.11 Time Base Accuracy

5.11.1 Description

An external sine wave generator of **10.0 MHz** with frequency accuracy better than 1 PPM is used. The signal is sampled at a very slow sample rate to obtain high resolution. The frequency measured will be the error value.

Specifications

Timebase clock : accuracy : ≤ **±10 PPM @ 5°C - 40°C**

5.11.2 Time Base Clock Verification Procedure

- Recall **Timebase Accuracy.lss** or configure the DSO

Panel Setups	:	**Recall FROM DEFAULT SETUP**
Channels trace ON		**Channel 1**

Input gain	:	**.1 V/div.**
Input offset	:	**0 mV**
Trigger setup	:	**Edge**
Trigger on	:	**C1**
Slope 1	:	**Pos**
Level 1	:	**0.0 mV**
Trigger mode	:	**Norm**
Delay	:	**0 %**
Time base	:	**500 msec/div.**
Active Channels	:	**1**
Sampling mode	:	**Real Time**
Max Sample points:		**500 kS minimum**
Measure	:	**Parameters**
P1	:	**Amplitude of C1**
P2	:	**Frequency of C1**

- Connect the **RF output** of the signal generator through a 50 Ohm coaxial cable into Channel 1.
- Set the generator frequency to **10.0 MHz**.
- Adjust the generator output amplitude to get **6 divisions peak to peak.**
- Read of the frequency parameter (to 2 decimal places) and record the value in Table 19.
- Verify that the error is less than 100 Hz.

LeCroy Digital Storage Oscilloscope

Performance Certificate

WaveSurfer Xs Manual Performance Test Procedure Version C Aug. 2007

Model_____ Serial Number_____ Customer_____

Software Version_____

Inspection Date_____ Next Due_____

Temperature_____ Humidity_____%

Tested By_____ Report Number_____

Place of Inspection_____

Condition found_____ Condition Left_____

Approved By_____

Test Equipment Used

Instrument	Model	S/N	Cal Due Date
Signal Generator Radio Frequency	_____	_____	_____
Signal Generator Audio Frequency	_____	_____	_____
Voltage Generator DC Power Supply	_____	_____	_____
Digital Multimeter	_____	_____	_____
Power Meter	_____	_____	_____
Power Sensor	_____	_____	

Traceable to_____

Table 1: WaveSurfer Xs Test Report

This page intentionally left blank

Coupling	Volts/div.	Measured Channel 1 Impedance Ω, MΩ	Measured Channel 2 Impedance Ω, MΩ	Measured Channel 3 Impedance Ω, MΩ	Measured Channel 4 Impedance Ω, MΩ	Measured External Impedance Ω, MΩ	Lower Limit Ω, MΩ	Upper Limit Ω, MΩ	104xs limits only Lower Limit Ω, MΩ	104xs limits only Upper Limit Ω, MΩ
DC 50Ω	20 mV/div						49.5 Ω	50.5 Ω	49.25 Ω	50.75 Ω
DC 50Ω	200 mV/div						49.5 Ω	50.5 Ω	49.25 Ω	50.75 Ω
DC 1MΩ	20 mV/div						0.990 MΩ	1.010 MΩ	0.9875 MΩ	1.0125 MΩ
DC 1MΩ	200 mV/div						0.990 MΩ	1.010 MΩ	0.9875 MΩ	1.0125 MΩ
DC 1MΩ	2 V/div						0.990 MΩ	1.010 MΩ	0.9875 MΩ	1.0125 MΩ
DC 50Ω							49.5 Ω	50.5 Ω	49.25 Ω	50.75 Ω
DC 1MΩ							0.990 MΩ	1.010 MΩ	0.9875 MΩ	1.0125 MΩ

Table 2: Impedance Test Record

Coupling	Volts/div.	Measured Channel 1 Leakage mV	Measured Channel 2 Leakage mV	Measured Channel 3 Leakage mV	Measured Channel 4 Leakage mV	Measured External Leakage mV	Lower Limit mV	Upper Limit mV
DC 50Ω	20 mV/div						–2	+2
DC 50Ω	200 mV/div						-2	+2
DC 1MΩ	20 mV/div						–2	+2
DC 1MΩ	200 mV/div						–2	+2
DC 1MΩ	2V/div						–2	+2
AC 1MΩ	20 mV/div						–2	+2
DC 50Ω							–2	+2
DC 1MΩ							–2	+2

Table 3: Leakage Voltage Test Record

V/Div	Measured SDEV Channel 1 mV	Measured SDEV Channel 2 mV	Measured SDEV Channel 3 mV	Measured SDEV Channel 4 mV	Limits SDEV mV
2 mV					0.23
5 mV					0.32
10 mV					0.45
20 mV					0.90
50 mV					2.24
100 mV					4.45
200 mV					9.0
500 mV					22.4
1V					45

Table 4: 50 Ohm Sdev Noise Test Record

V/Div	Measured SDEV Channel 1 mV	Measured SDEV Channel 2 mV	Measured SDEV Channel 3 mV	Measured SDEV Channel 4 mV	Limits SDEV mV 50 Ohm	Limits SDEV MV 1 Mohm
2 mV					0.337	0.357
5 mV					0.532	0.563
10 mV					0.753	0.753
20 mV					1.07	1.07
100 mV					7.53	7.53
200 mV					10.65	10.65
2V						106.54

Table 5: Sdev Noise Test Record (WS104xs only)

Volts /div.	Attenuator	P S Output	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
			DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	mV
2 mV	X 100	+0.06 V													±1.37
5 mV	X 100	+1.5 V													±2.3
10 mV	X 10	+0.3V													±2.25
50 mV	X 10	+0.15 V													±9.5
100mV	X 1	+0.3V													±13.5
200mV	X 1	+0.6 V													±26
1v	X 1	+3.0 V													±126

Table 6: DC 50Ω, Positive DC Accuracy Test Record

Volts /div.	Attenuator	P S Output	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
			DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	mV
2 mV	X 100	+0.06 V													±1.37
5 mV	X 100	+1.5 V													±2.3
10 mV	X 10	+0.3V													±2.25
50 mV	X 10	+1.5 V													±9.5
100mV	X 1	+0.3V													±13.5
200mV	X 1	+0.6 V													±26
1v	X 1	+3.0 V													±126

Table 7: DC 50Ω, Negative DC Accuracy Test Record

Volts /div.	Attenuator	P S Output	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
			DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	mV
2 mV	X 100	+0.06 V													±1.37
5 mV	X 100	+1.5 V													±2.3
10 mV	X 10	+0.3V													±2.25
50 mV	X 10	+1.5 V													±9.5
100mV	X 1	+0.3V													±13.5
200mV	X 1	+0.6 V													±26
1v	X 1	+3.0 V													±126

Table 8: DC 1MΩ, Positive DC Accuracy Test Record

Volts /div.	Attenuator	P S Output	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
			DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	mV
2 mV	X 100	+0.06 V													±1.37
5 mV	X 100	+1.5 V													±2.3
10 mV	X 10	+0.3V													±2.25
50 mV	X 10	+1.5 V													±9.5
100mV	X 1	+0.3V													±13.5
200mV	X 1	+0.6 V													±26
1v	X 1	+3.0 V													±126

Table 9: DC 1MΩ, Negative DC Accuracy Test Record

Volt /div.	Coupling DC	DSO Offset V	P S Output V	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
				DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	Note1 ±14.2 Note2
50mV	50 Ω	+.750	–.750													±16.2

Table 10: Positive 50Ω Offset Test Record

Volt /div.	Coupling DC	DSO Offset V	P S Output V	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
				DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	Note1 ±14.2 Note2
50mV	50 Ω	+.750	–.750													±16.2

Table 11: Negative 50Ω Offset Test Record

Volt /div.	Coupling DC	DSO Offset V	P S Output V	Measured Channel 1 V & mV			Measured Channel 2 V & mV			Measured Channel 3 V & mV			Measured Channel 4 V & mV			Limits
				DMM 1	Mean (A)	Δ 1 Mean–DMM	DMM 2	Mean (B)	Δ 2 Mean–DMM	DMM 3	Mean (C)	Δ 3 Mean–DMM	DMM 4	Mean (D)	Δ 4 Mean–DMM	Note1 ±14.2 Note2
50mV	1 MΩ	+.750	–.750													±16.2

Table 12: Positive 1MΩ Offset Test Record

*NOTE 1: Offset limit for the model 24/4x/6xXs is +/-14.2mV
*NOTE 2: Offset limit for the model 104Xs is +/-16.2mV

Frequency	Measured Power	Generator Amplitude	Measured Channel 1		Measured Channel 2		Measured Channel 3		Measured Channel 4		Lower Limit
MHz	mW	mV	sdev(1) mV	Ratio(1) to 10	sdev (2) mV	Ratio(2) to 10	sdev (3) mV	Ratio(3) to 10	sdev (4) mV	Ratio(4) to 10	
10	0.8			N/A		N/A		N/A		N/A	N/A
200.1 (WS 24Xs)	0.8										0.707
400.1 (WS 44Xs)	0.8										0.707
400.1 (WS 42Xs)	0.8						N/A	N/A	N/A	N/A	0.707
600.1 (WS 62Xs)	0.8						N/A	N/A	N/A	N/A	0.707
600.1 (WS 64Xs)	0.8										0.707
1000.1 (WS 104Xs)	0.8										0.707

Table 16: DC 50Ω, 100 mV/div. Bandwidth Test Record

Frequency	Measured Power	Generator Amplitude	Measured Channel 1		Measured Channel 2		Measured Channel 3		Measured Channel 4		Lower Limit
MHz	mW	mV	sdev(1) mV	Ratio(1) to 10	sdev (2) mV	Ratio(2) to 10	sdev (3) mV	Ratio(3) to 10	sdev (4) mV	Ratio(4) to 10	
10	22.0			N/A		N/A		N/A		N/A	N/A
200.1 (WS 24Xs)	22.0										0.707
400.1 (WS 44Xs)	22.0										0.707
400.1 (WS 42Xs)	22.0						N/A	N/A	N/A	N/A	0.707
600.1 (WS 62Xs)	22.0						N/A	N/A	N/A	N/A	0.707
600.1 (WS 64Xs)	22.0										0.707
1000.1 (WS 104Xs)	22.0										0.707

Table 17: DC 50Ω, 500mV/div. Bandwidth Test Record

Trigger Level	Trigger Slope	Channel 1	Channel 2	Channel 3	Channel 4	Lower Limit	Upper Limit
mV		Measured DC Trigger Level (1) mV	Measured DC Trigger Level (2) mV	Measured DC Trigger Level (3) mV	Measured DC Trigger Level (4) mV	mV	mV
0	Pos					–34	+34
0	Neg					–34	+34
+250	Pos					+216	+284
+250	Neg					+216	+284
–250	Pos					-284	-216
–250	Neg					-284	-216

Table 18: Channel DC Trigger Test Record

Generator Frequency MHz	Freq.(1) (Hz)	Lower Limit	Upper Limit
10.0		-100	+100

Table 19: Time Base Test Record

6. Maintenance

6.1 Introduction

This section contains information necessary to disassemble, assemble, maintain, calibrate and troubleshoot the LeCroy WaveSurfer Xs Series.

6.1.1 Safety Precautions

The symbol used in this manual indicates dangers that could result in personal injury.

The symbol used in this manual identifies conditions or practices that could damage the instrument.

The following servicing instructions are for use by qualified personnel only. Do not perform any servicing other than contained in service instructions. Refer to procedures prior to performing any service.

Exercise extreme safety when testing high energy power circuits. Always turn the power OFF, disconnect the power cord and discharge all capacitors before disassembling the instrument.

6.1.2 Anti-static Precautions

Any static charge that builds on your person or clothing may be sufficient to destroy CMOS components, integrated circuits, Gate array's.....etc.

In order to avoid possible damage, the usual precautions against static electricity are required.

- Handle the boards in anti-static boxes or containers with foam specially designed to prevent static build-up.
- Ground yourself with a suitable wrist strap.
- Disassemble the instrument at a properly grounded work station equipped with anti-static mat.
- When handling the boards, do not touch the pins.
- Stock the boards in anti-static bags.

6.2 Disassembly and Assembly Procedure

The disassembly and assembly procedures detailed below refer to the views of figures shown in section 8.

6.2.1 Disassembly Procedure

Please study the figures in section 8 before attempting disassembly. Before removing any parts from the LeCroy WaveSurfer, be sure to read carefully the instructions referring to those parts, noting any precautions needed to avoid problems.

Note: Power is always present on the CPU motherboard and inside the Power Supply whenever the power cord is plugged into a power source. Remove the power cord from the instrument before removing or inserting any connectors to the CPU motherboard. Extreme caution should be taken in protecting the LCD face from damage (e.g. scratch marks, etc.) when handling, in particular when inserting or removing from the instrument.

a. Removal of the Back shell and Box Top

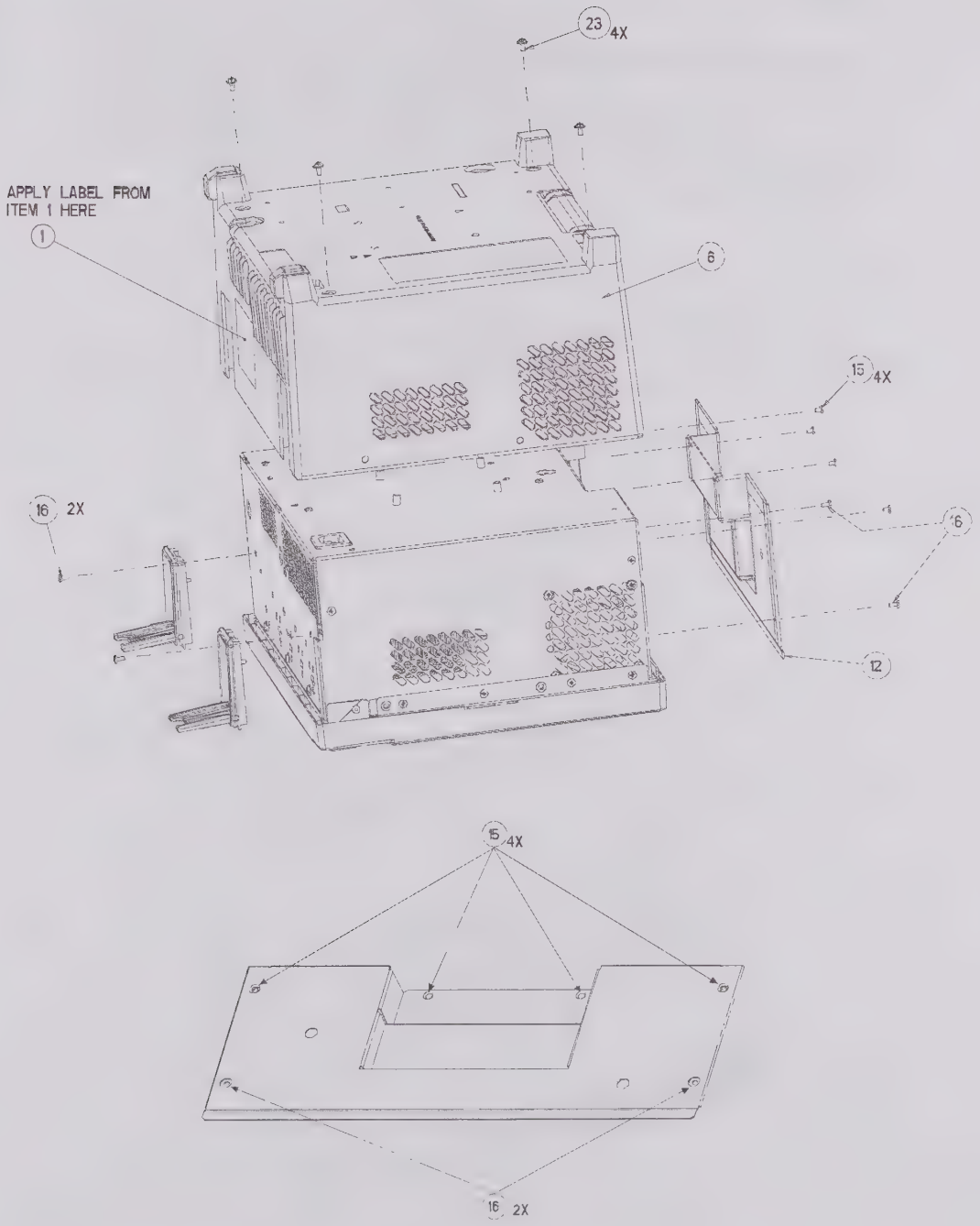
The upper cover disassembly procedure refers to the view of figure 8-1.

Tools Needed:

- T10 Torx driver
- T8 Torx driver
- #2 Philips screwdriver

Procedure:

- Remove four M3x6 ECO-fix screws (23) from the rear of the back shell
- Remove back shell (6)
- Remove four M3x5 Pan head screws (15)
- Remove two M3 flat undercut screws (16)
- Remove box top (12)


23 4X
APPLY LABEL FROM ITEM 1 HERE
1
6
15 4X
16 2X
6
12
15 4X
16 2X

b. Removal of the Front Frame Assy

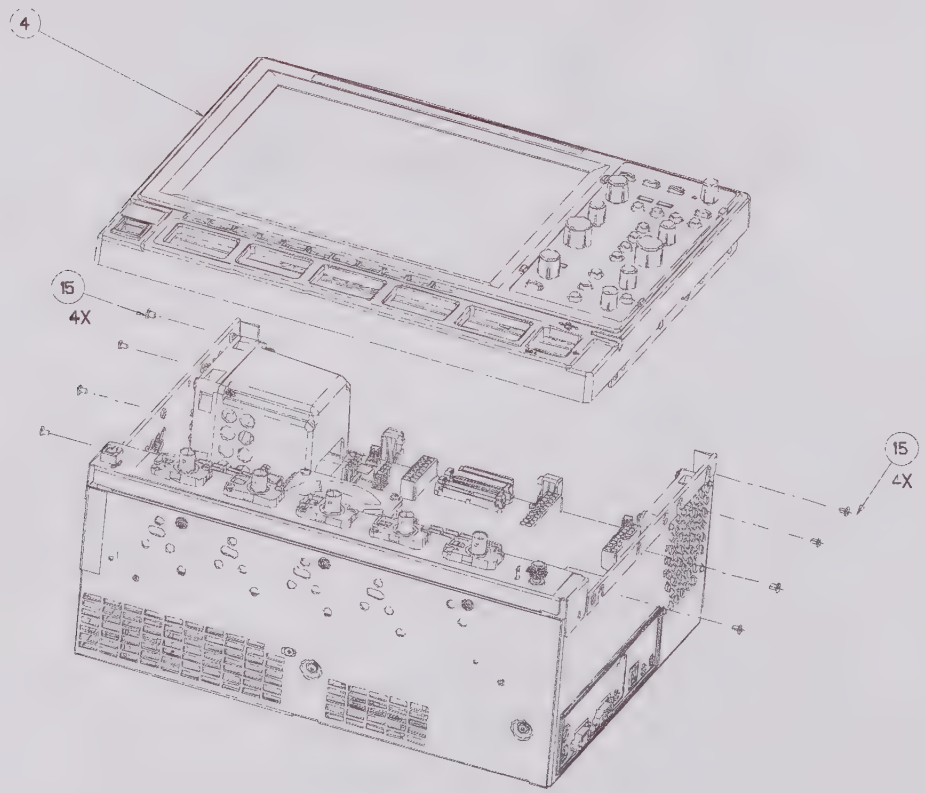
The front bezel disassembly procedure refers to the view of figure 8-2.

Tools Needed:

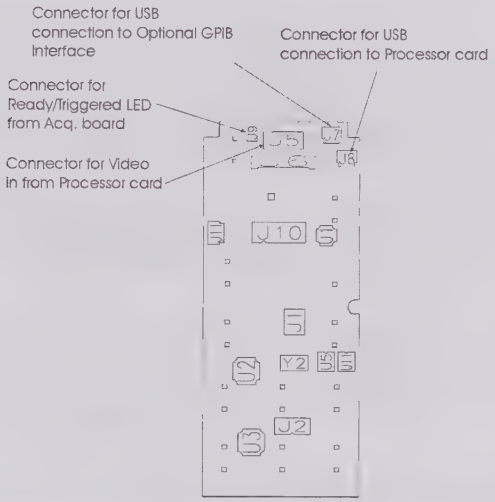
- T8 Torx driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove four M3 flat undercut screws (15) from each side of the front frame
- Slightly remove front bezel (4) from chassis



- Disconnect video cable at J5 of front panel
- Disconnect ready/trigger LED cable at J9 of front panel
- Disconnect USB cable at J8 of front panel
- Disconnect ribbon cable from hard drive
- Disconnect input power cable to bottom of TFT inverter board



- Remove front frame assy

c. Removal of the Acquisition System Assembly

The Acquisition System removal procedure refers to the view of figure 8-1 & 8-4.

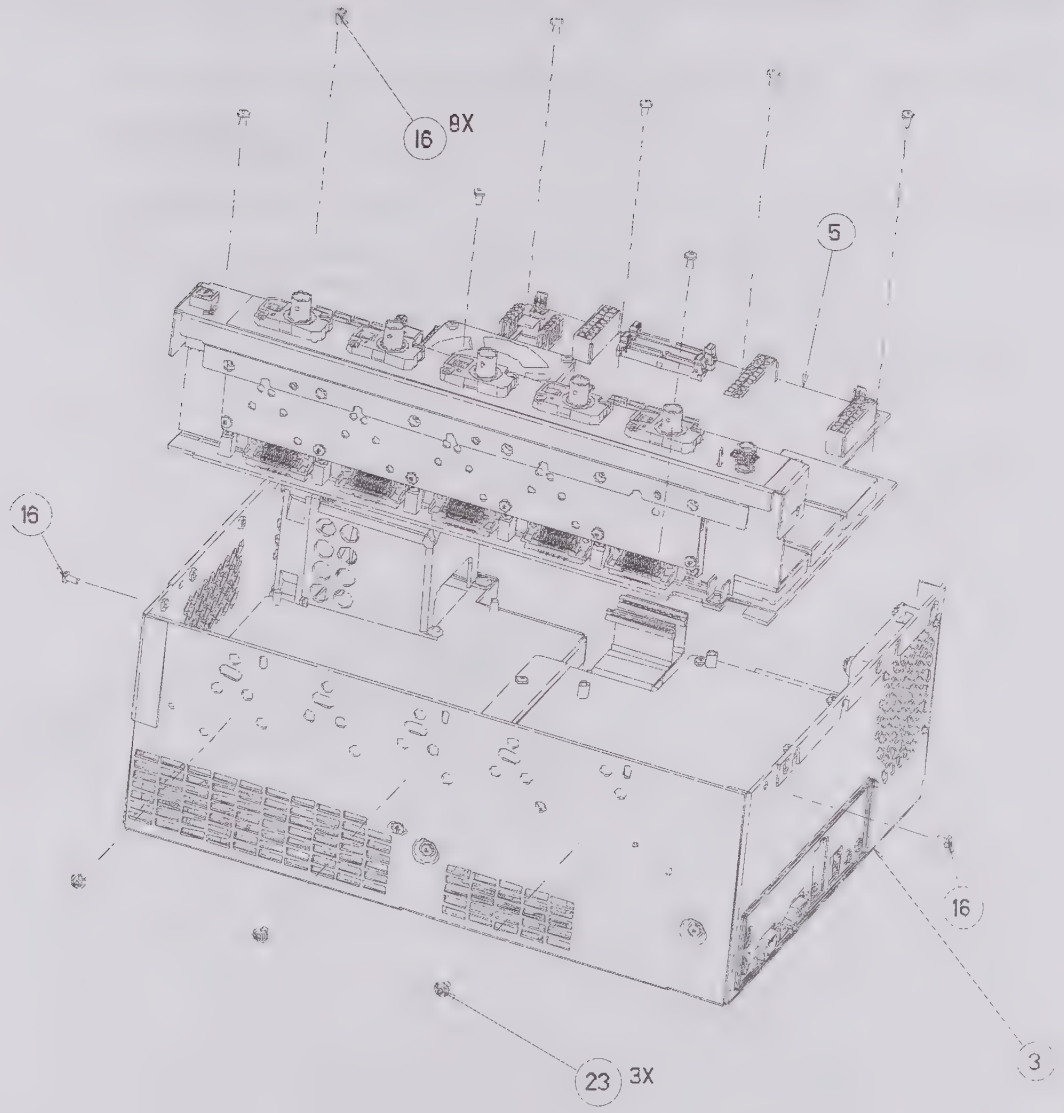
Tools Needed:

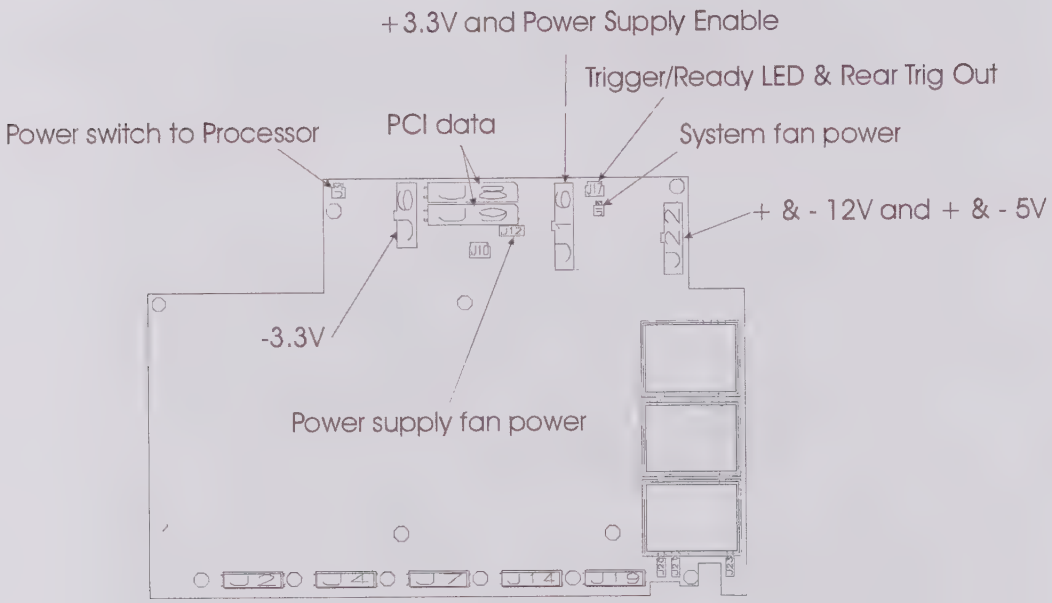
- Torx 10 Driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove Front frame assy (6.2.1.b)
- Remove one M3x6 screw (16) on each side
- Remove three M3x6 ECO-fix screws (23) from bottom of main card panel into bottom of chassis
- Disconnect three power cables to Acq board at location J6, J16 & J22
- Disconnect two ribbon cables to Acq board at locations J8 & J9
- Disconnect ready/trigger LED and rear trigger out cable from Acq Board at location J17
- Disconnect power switch cable to CPU motherboard at Acq Board location J3
- Disconnect power supply fan connector to Acq Board at location J12
- Disconnect right side system fan power cable from Acq board at location J18
- Disconnect USB cable at J22 of front end card (this is for the front panel USB cable)
- Remove eight M3x6 pan head screws (16) which secure the Acq board to the chassis
- Slightly tilt the acquisition board (5) to one side and remove from chassis (pay attention that USB cable to the front end card does not stuck)

The acquisition system can now be removed from the oscilloscope.


16 8X
5
16
16
3
23 3X


+3.3V and Power Supply Enable
Trigger/Ready LED & Rear Trig Out
Power switch to Processor
PCI data
System fan power
+ & - 12V and + & - 5V
-3.3V
Power supply fan power

d. Removal of the Front End Card

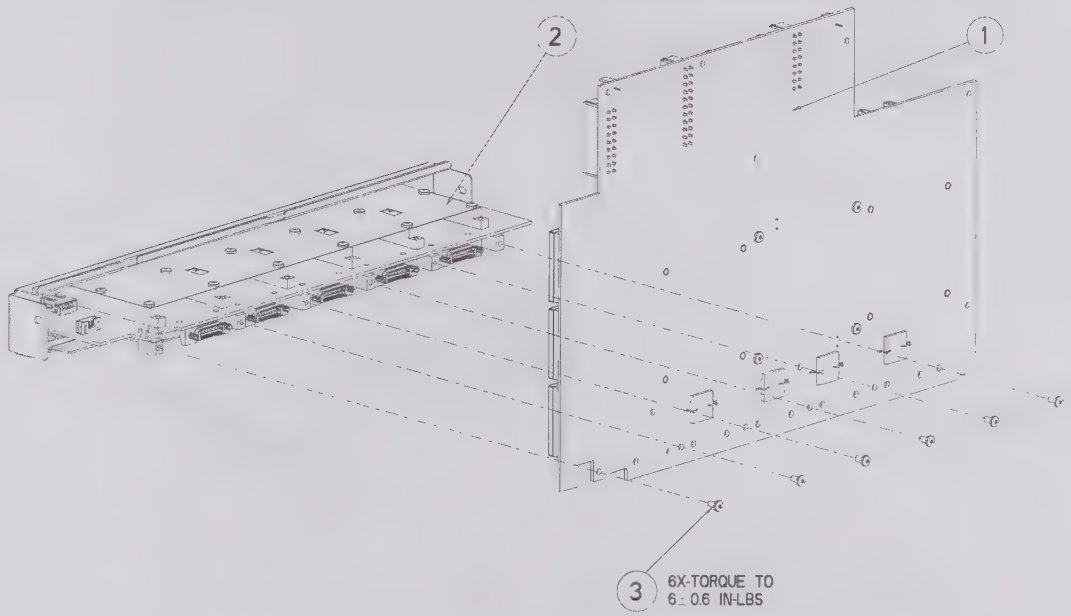
The PCI board removal procedure refers to the views of figure 8-5 and figure 8-9

Tools Needed:

- Torx 10 Driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove Front frame assy (6.2.1.b)
- Remove Acquisition system (6.2.1.c)
- Remove six M3x6 screws (3) which secure front end assy. (2) to acq. board (1)
- Remove front end ASSY (2)



e. Removal of the Acquisition support plate

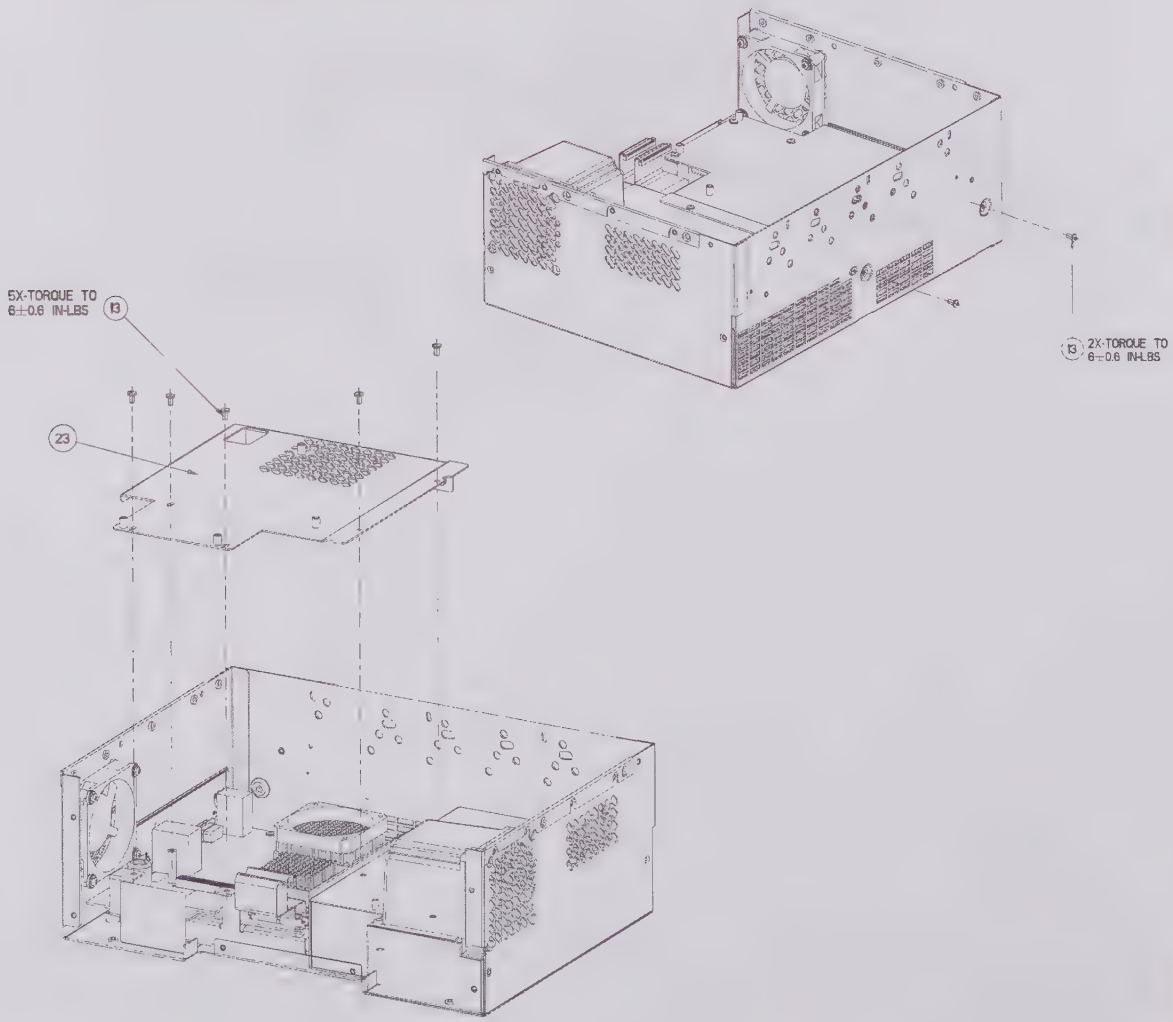
The PCI board removal procedure refers to the views of figure 8-5 and figure 8-9

Tools Needed:

- Torx 10 Driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove Front frame assy (6.2.1.b)
- Remove Acquisition system (6.2.1.c)
- Remove two M3x6 screws (13) through bottom of chassis to acquisition support plate
- Remove five M3x6 screws (13) from front side of acquisition support plate
- Remove acquisition support plate (23)



f. Removal of the PCI Board

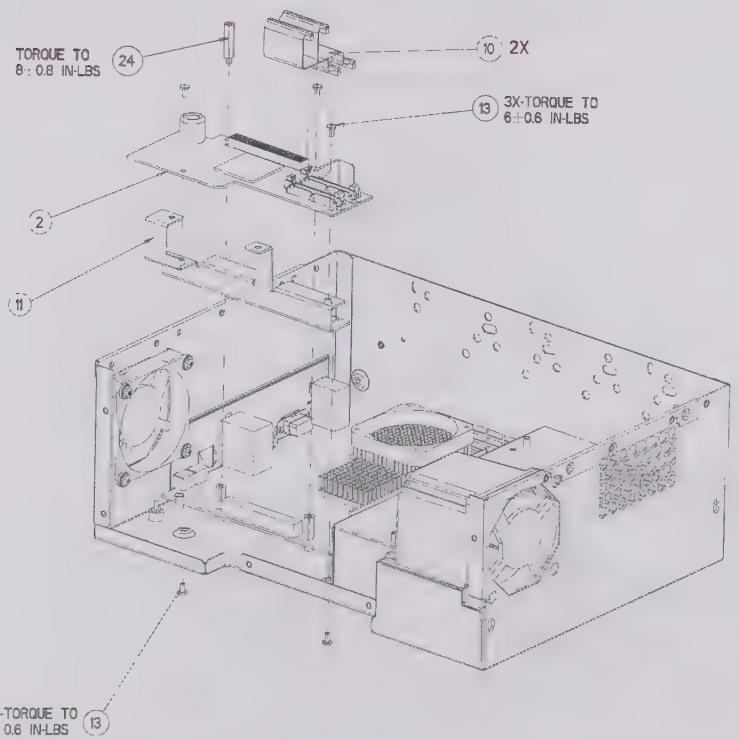
The PCI board removal procedure refers to the views of figure 8-5 and figure 8-9

Tools Needed:

- Torx 10 Driver
- ¼ " Nut Driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove Front frame assy (6.2.1.b)
- Remove Acquisition system (6.2.1.c)
- Remove acquisition support plate (6.2.1.e)
- Remove two M3x6 screws (13) which secure top edge of PCI card to PCI support bracket
- Remove one M3x23 standoff (24) and one M3x6 screw (13) which secure PC104+ connector of PCI card to CPU motherboard
- Remove PCI support bracket (11) by removing two M3x6 screws through the rear of the chassis
- Remove PCI card (2)



g. Removal of the Power Supply

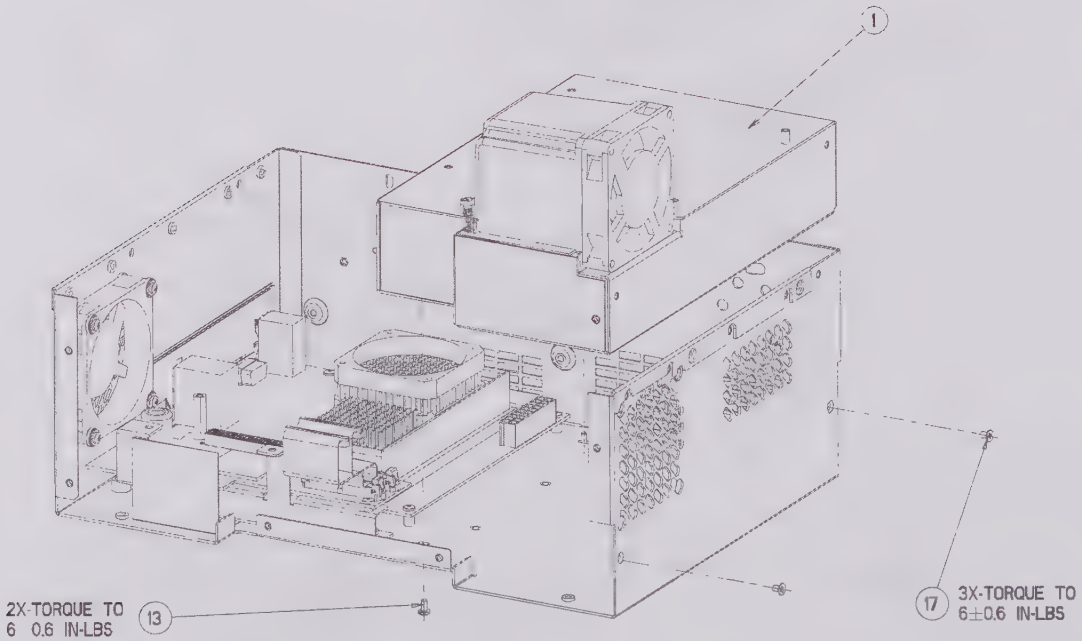
The power supply fan removal procedure refers to the views of figure 8-6.

Tools Needed:

- T10 Torx drive
- T8 Torx drive

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove Front frame assy (6.2.1.b)
- Remove Acquisition system (6.2.1.c)
- Remove acquisition support plate (6.2.1.e)
- Remove two M3 flat undercut screws (17) through the left side of chassis to the power supply
- Remove two M3x6 screws (13) through the rear of chassis to the power supply (note that the top screw has a washer)
- Remove one M3 flat undercut screw (17) through the bottom of the chassis to the power supply
- Disconnect power cable from processor card
- Remove the power supply (1)



h. Removal of the Processor Board

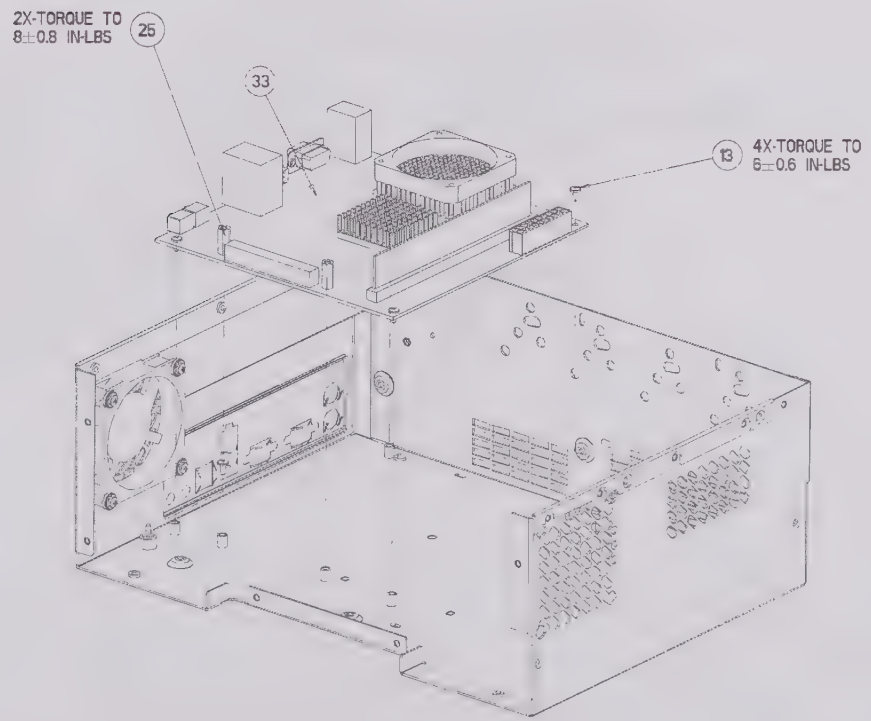
The processor board disassembly procedure refers to the views of figure 8-7 and figure 8-9.

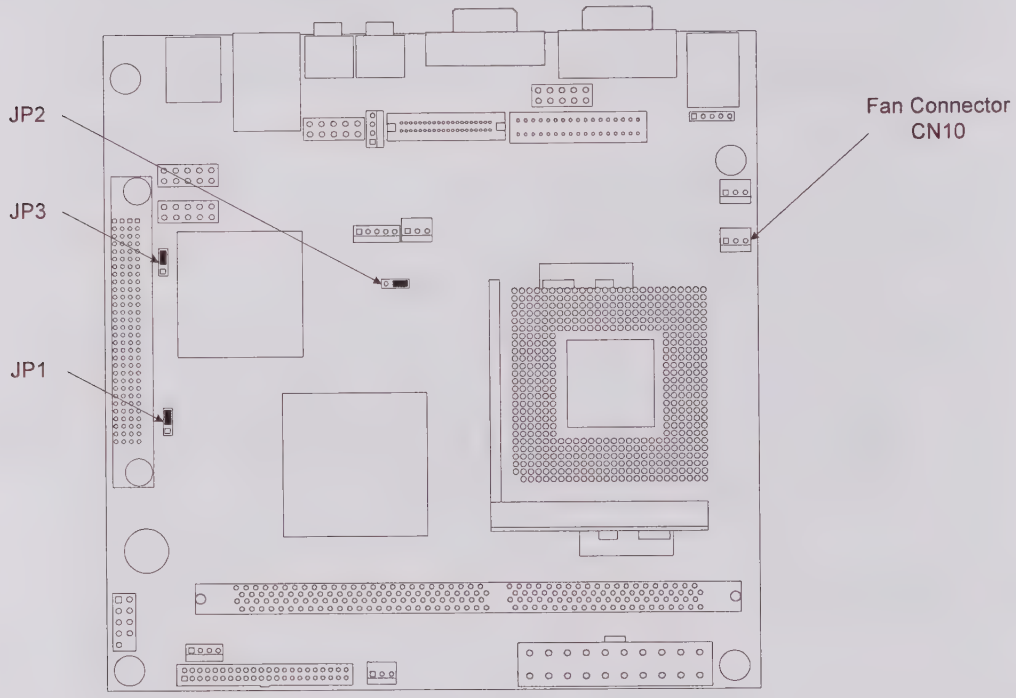
Tools Needed:

- Torx 10 Driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove Front frame assy (6.2.1.b)
- Remove Acquisition system (6.2.1.c)
- Remove acquisition support plate (6.2.1.e)
- Remove PCI card (6.2.1.f)
- Disconnect power cable from processor card
- Remove power supply (6.2.1.g)
- Remove four M3x6 screws (13) and two M3x15 standoffs (23) which secure the processor card to the chassis (a long screwdriver can be used to reach the screw which is underneath the right side system fan)
- Remove the processor card with its cables attached





WaveSurfer Mother Board

i. Removal of the Front Frame

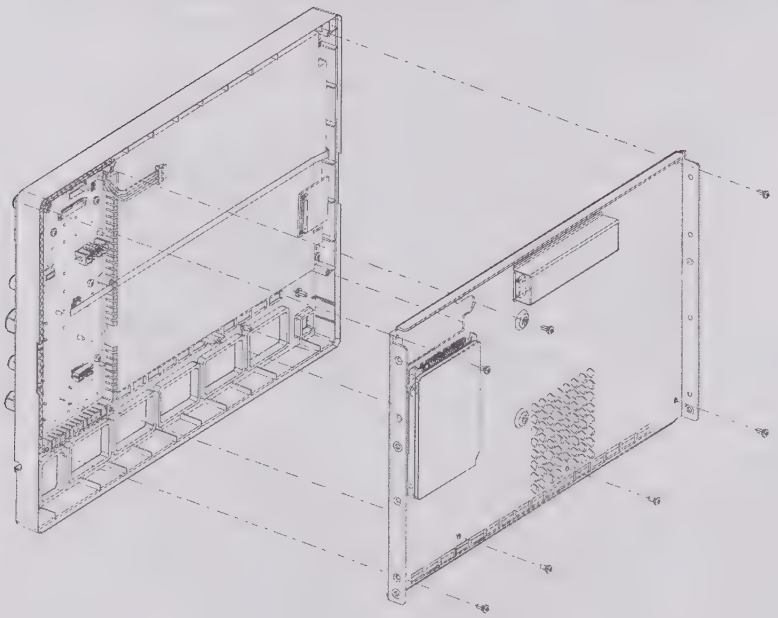
The hard disk drive removal procedure refers to the view of figure 8-7 and 8-9.

Tools Needed:

- #1 Philips screwdriver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove the front frame assy (6.2.1.b)
- Disconnect the TFT power cable from the DC-AC inverter
- Slide the bushing around the TFT power wires out from the front frame
- Remove seven M3x6 self tapping screws (X) which secure the front frame to the front bezel
- Remove the front frame (X)



j. Removal of the Hard Drive

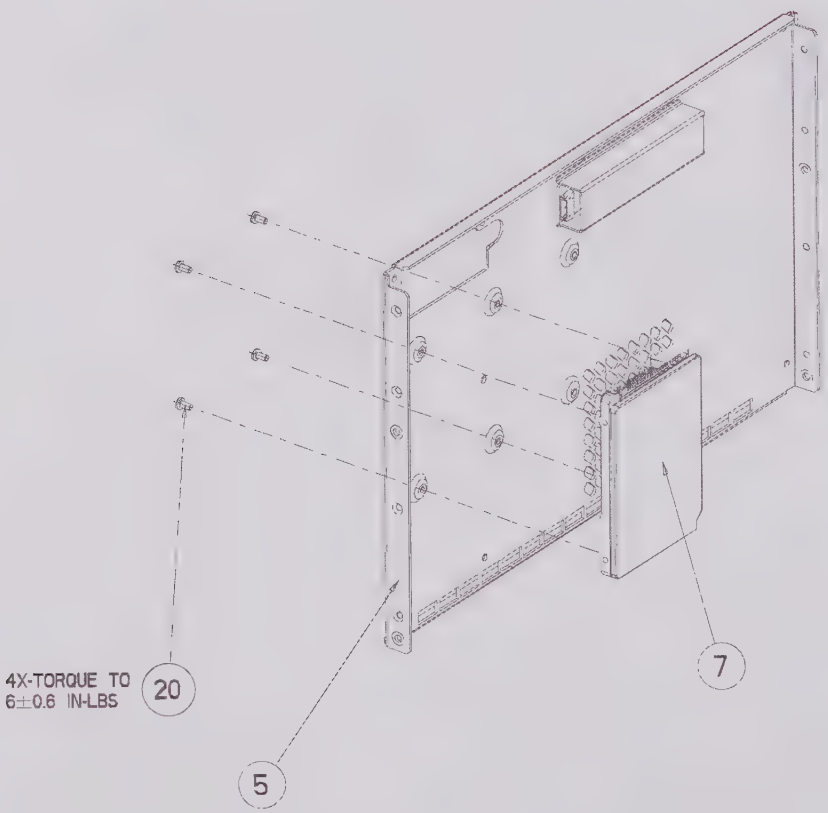
The hard disk drive removal procedure refers to the view of figure 8-7 and 8-9.

Tools Needed:

- Torx 10 Driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove the front frame assy (6.2.1.b)
- Remove the front frame (6.2.1.i)
- Disconnect the TFT power cable from the DC-AC inverter
- Slide the bushing around the TFT power wires out from the front frame
- Remove the four M3x6 screws (20) which secure the hard disk drive to the front frame (5)
- Remove the hard drive (7)



k. Removal of the Front Panel Encoder Board

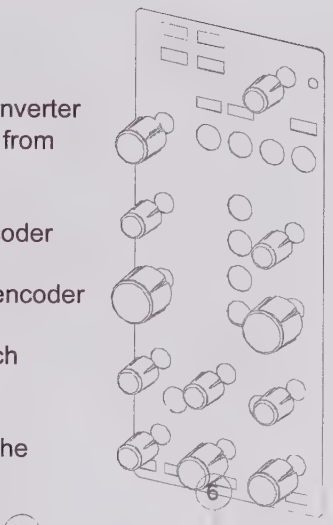
The front panel encoder board removal procedure refers to the views of figure 8-4 and figure 8-13.

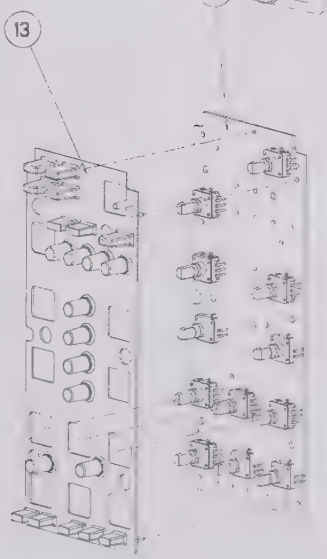
Tools Needed:

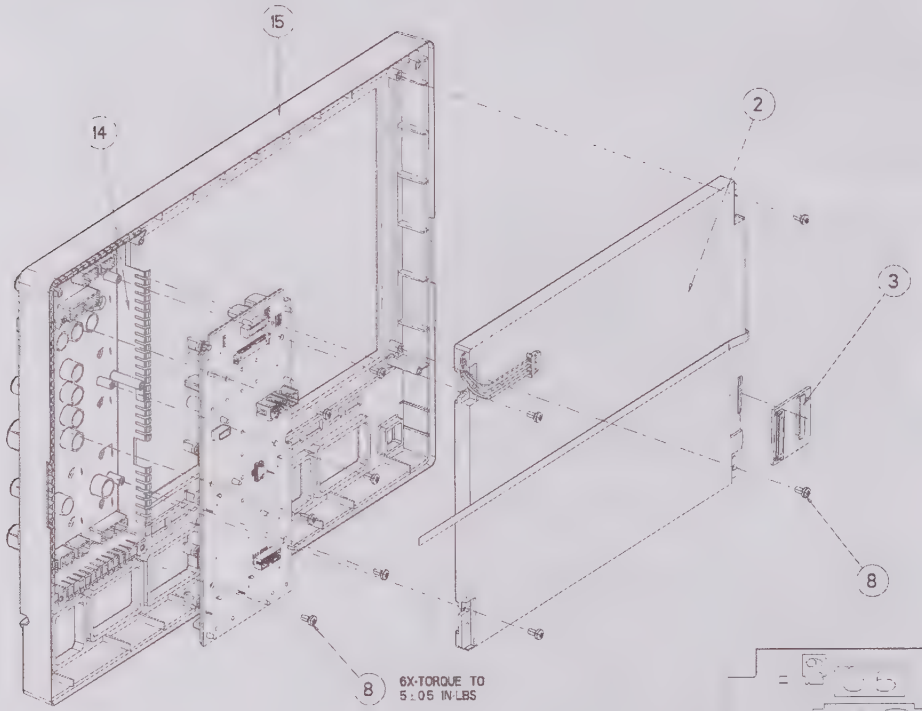
- T10 Torx driver

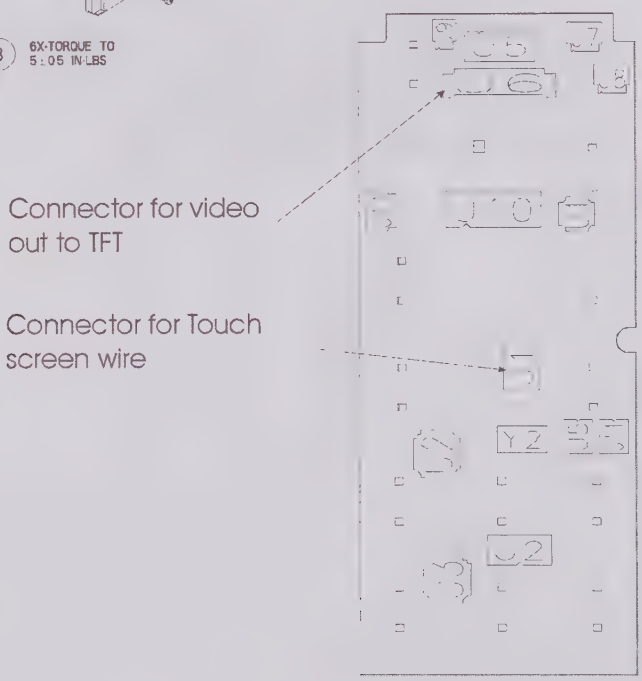
Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove the front frame assy (6.2.1.b)
- Remove all of the knobs from the front panel
- Disconnect the TFT power cable from the DC-AC inverter
- Slide the bushing around the TFT power wires out from the front frame
- Remove the front frame (6.2.1.i)
- Disconnect the TFT video cable from J6 of the encoder board
- Disconnect the touch screen cable from J1 of the encoder board
- Remove the five M3x6 self tapping screws (8) which secure the encoder board to the front bezel
- Remove the front panel encoder board (6)
- Remove the elastomeric keypad (13) by grasping the rubber tabs which protrude through the PCB (6) and stretching them out slightly, this will cause them to loose their grip on the PCB and it can then be removed. Repeat for all tabs.






15
14
2
3
8
8
6X-TORQUE TO
5 : 05 IN-LBS


Connector for video
out to TFT
Connector for Touch
screen wire

I. Removal of the Display Inverter Board

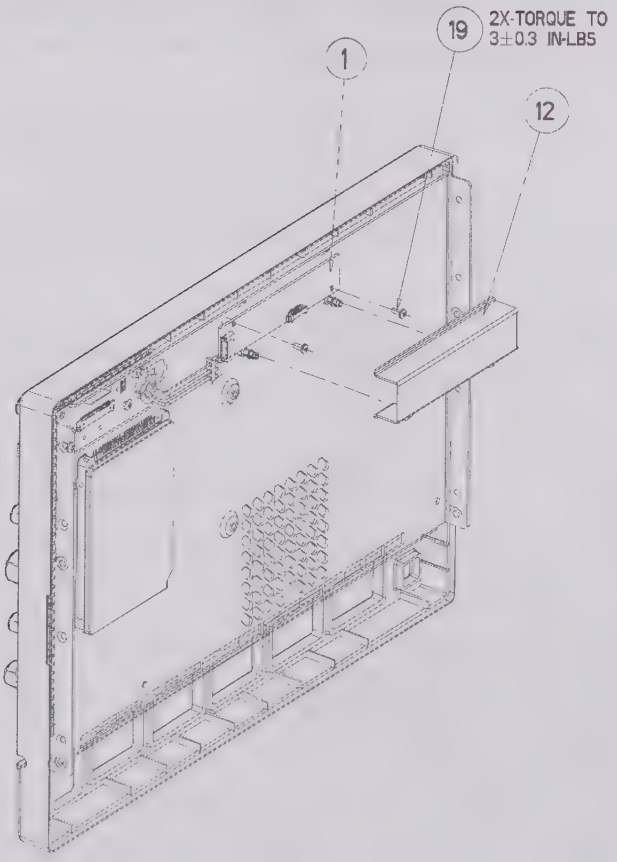
The display inverter removal procedure refers to the view of figure 8-4 & 8-16.

Tools Needed:

- T8 Torx driver

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove the front frame assy (6.2.1.b)
- Disconnect the TFT power cable from the DC-AC inverter
- Using a flat bladed screwdriver, unsnap the Inverter cover (12) from the posts on the front frame and slide the two tabs which secure the other edge of the shield out of the slots in the front frame.
- Remove the two M2.5x6 screws (19) which secure the display inverter (1) to the front frame.
- Remove the display inverter



m. Removal of the Display and Touchscreen

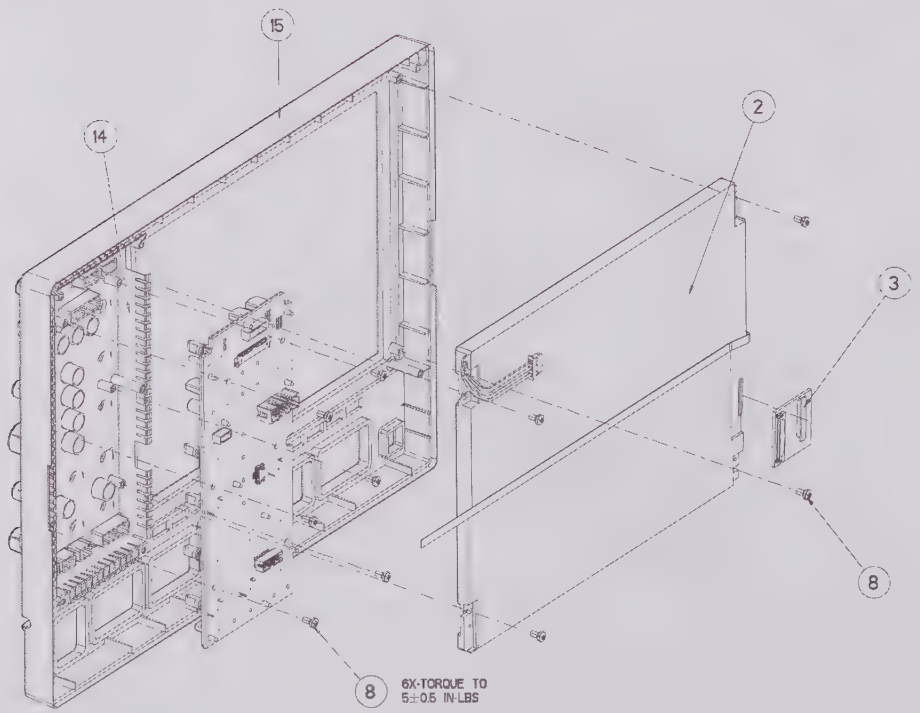
The display and touchscreen removal procedure refers to the view of figure 8-4, figure 8-15 and figure 8-16.

Tools Needed:

- T10 Torx driver
- #1 Philips

Procedure:

- Remove back shell & box top (6.2.1.a)
- Remove the front frame assy (6.2.1.b)
- Remove the front frame (6.2.1.i)
- Disconnect the TFT video cable from the VST board
- Unplug the VST board (3) from the TFT and remove from unit
- Remove the four M3x6 self tapping screws (8) which secure the TFT (2) to the front bezel
- Remove the TFT (2) from the front bezel

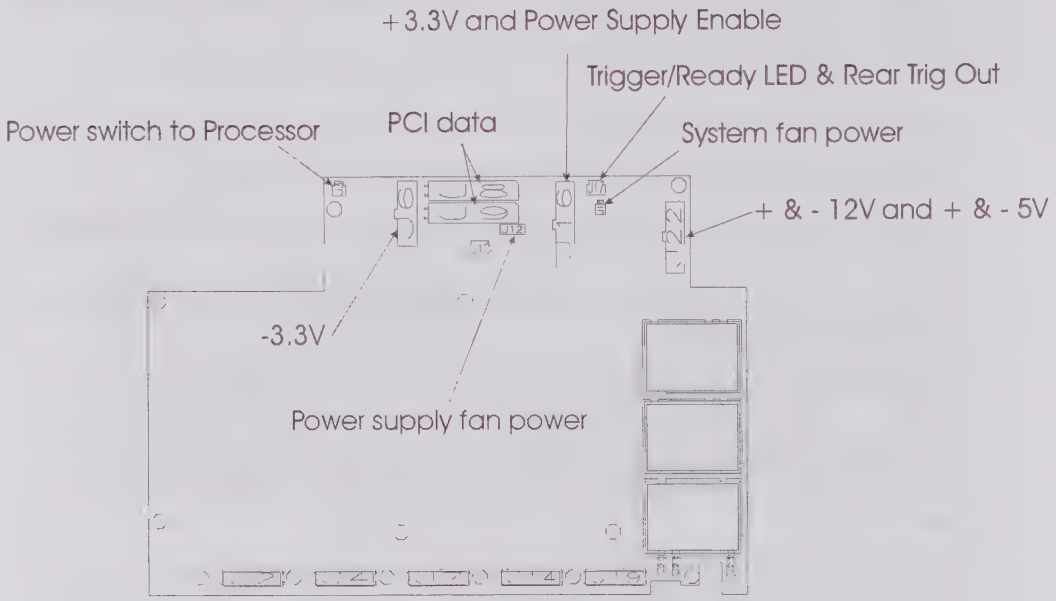


Assembly Procedure

Reassemble the unit in the reverse order, check that all screws shown on the drawings in section 8 are used and have the proper torque. Verify that all cables are correctly connected.

Assembly Note :

- **Bezel** : The plastic bezel should not be in contact with the touch screen.
- **Fans** : Check the fan air flow, the fans blow air down into the unit.
- **Feet** : Check that the lower feet and rear feet are aligned and properly tightened before re-assembly.
- **CD**: Check that the tray moves freely and shuts correctly. Insert a CD and eject it to check the mechanism.
- **Front Panel** : Check that knobs rotate freely, are the right size and in the right place.
- **Acquisition Board** : Make sure that no heatsinks get knocked from their fully seated position as intimate contact is required between the heatsink and the devices.
- **Processor** : Check that all of the cables are correctly inserted. The BIOS must be flashed if new CPU card is installed.
- **Printer** : If the graphic printer is used, before closing the top cover don't forget to plug the input power cable to the option and the driver cable to the USB Hub card.
- **Hard Drive** – Hard Drive image will need to be restored (depends on version of CPU motherboard) Touch Screen calibration will need to be performed if hard drive is replaced. Critical files will need to be restored (see section 6.6) or full factory calibration performed.
- **PCI Card** – If board is replaced, software keys for software option licensing and model identification will need to be reissued.
- **USB Hub Card** – Make sure that video cable to TFT is tie-wrapped to the mounting block.

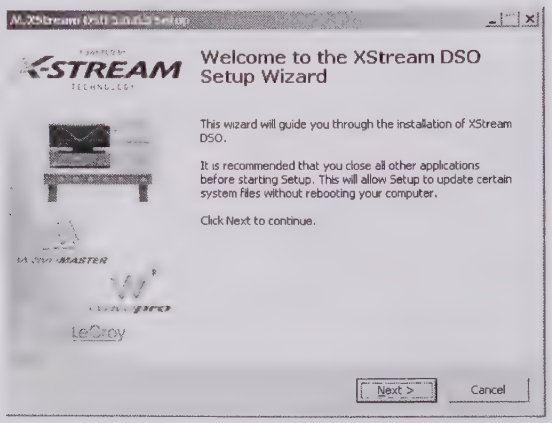

+3.3V and Power Supply Enable
Trigger/Ready LED & Rear Trig Out
Power switch to Processor
PCI data
System fan power
+ & - 12V and + & - 5V
-3.3V
Power supply fan power

6.3 Software Update Procedure

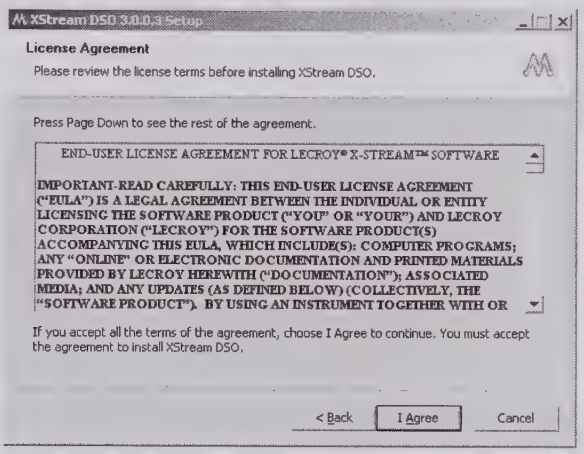
6.3.1 Installing New X-Stream DSO Application Software

In order to load new X-Stream DSO software the system must be capable of booting up to the Windows desktop.

- If the Wavemaster application is running, exit it through the File, Exit menu option.
- Insert the CD ROM containing the version to be installed into the CD ROM drive.
- From the windows desktop, select My Computer, then select the CD ROM drive.
- Launch XStreamDSOInstallerx.x.x.x.exe (where x.x.x.x is the version number) application.


X-STREAM
Welcome to the XStream DSO Setup Wizard
This wizard will guide you through the installation of XStream DSO.
It is recommended that you close all other applications before starting Setup. This will allow Setup to update certain system files without rebooting your computer.
Click Next to continue.
LeCroy
Next >
Cancel

- Press Next, You will be prompted to read and accept the software license agreement.


XStream DSO 3.0.0.3 Setup
License Agreement
Please review the license terms before installing XStream DSO.
Press Page Down to see the rest of the agreement.
END-USER LICENSE AGREEMENT FOR LECROY® X-STREAM™ SOFTWARE
IMPORTANT-READ CAREFULLY: THIS END-USER LICENSE AGREEMENT ("EULA") IS A LEGAL AGREEMENT BETWEEN THE INDIVIDUAL OR ENTITY LICENSING THE SOFTWARE PRODUCT ("YOU" OR "YOUR") AND LECROY CORPORATION ("LECROY") FOR THE SOFTWARE PRODUCT(S) ACCOMPANYING THIS EULA, WHICH INCLUDE(S): COMPUTER PROGRAMS; ANY "ONLINE" OR ELECTRONIC DOCUMENTATION AND PRINTED MATERIALS PROVIDED BY LECROY HEREWITH ("DOCUMENTATION"); ASSOCIATED MEDIA; AND ANY UPDATES (AS DEFINED BELOW) (COLLECTIVELY, THE "SOFTWARE PRODUCT"). BY USING AN INSTRUMENT TOGETHER WITH OR
If you accept all the terms of the agreement, choose I Agree to continue. You must accept the agreement to install XStream DSO.
< Back
I Agree
Cancel

6.3.2 Software End User License Agreement

END-USER LICENSE AGREEMENT FOR LECROY® X-STREAM™ SOFTWARE

IMPORTANT-READ CAREFULLY: THIS END-USER LICENSE AGREEMENT ("EULA") IS A LEGAL AGREEMENT BETWEEN THE INDIVIDUAL OR ENTITY LICENSING THE SOFTWARE PRODUCT ("YOU" OR "YOUR") AND LECROY CORPORATION ("LECROY") FOR THE SOFTWARE PRODUCT(S) ACCOMPANYING THIS EULA, WHICH INCLUDE(S): COMPUTER PROGRAMS; ANY "ONLINE" OR ELECTRONIC DOCUMENTATION AND PRINTED MATERIALS PROVIDED BY LECROY HEREWITH ("DOCUMENTATION"); ASSOCIATED MEDIA; AND ANY UPDATES (AS DEFINED BELOW) (COLLECTIVELY, THE "SOFTWARE PRODUCT"). BY USING AN INSTRUMENT TOGETHER WITH OR CONTAINING THE SOFTWARE PRODUCT, OR BY INSTALLING, COPYING, OR OTHERWISE USING THE SOFTWARE PRODUCT, IN WHOLE OR IN PART, YOU AGREE TO BE BOUND BY THE TERMS OF THIS EULA. IF YOU DO NOT AGREE TO THE TERMS OF THIS EULA, DO NOT INSTALL, COPY, OR OTHERWISE USE THE SOFTWARE PRODUCT; YOU MAY RETURN THE SOFTWARE PRODUCT TO YOUR PLACE OF PURCHASE FOR A FULL REFUND. IN ADDITION, BY INSTALLING, COPYING, OR OTHERWISE USING ANY MODIFICATIONS, ENHANCEMENTS, NEW VERSIONS, BUG FIXES, OR OTHER COMPONENTS OF THE SOFTWARE PRODUCT THAT LECROY PROVIDES TO YOU SEPARATELY AS PART OF THE SOFTWARE PRODUCT ("UPDATES"), YOU AGREE TO BE BOUND BY ANY ADDITIONAL LICENSE TERMS THAT ACCOMPANY SUCH UPDATES. IF YOU DO NOT AGREE TO SUCH ADDITIONAL LICENSE TERMS, YOU MAY NOT INSTALL, COPY, OR OTHERWISE USE SUCH UPDATES.

THE PARTIES CONFIRM THAT THIS AGREEMENT AND ALL RELATED DOCUMENTATION ARE AND WILL BE DRAFTED IN ENGLISH. LES PARTIES AUX PRÉSENTÉS CONFIRMENT LEUR VOLONTÉ QUE CETTE CONVENTION DE MÊME QUE TOUS LES DOCUMENTS Y COMPRIS TOUT AVIS QUI S'Y RATTACHÉ, SOIENT REDIGÉS EN LANGUE ANGLAISE.

1. GRANT OF LICENSE.

1.1 License Grant. Subject to the terms and conditions of this EULA and payment of all applicable fees, LeCroy grants to you a nonexclusive, nontransferable license (the "License") to: (a) operate the Software Product as provided or installed, in object code form, for your own internal business purposes, (i) for use in or with an instrument provided or manufactured by LeCroy (an "Instrument"), (ii) for testing your software product(s) (to be used solely by you) that are designed to operate in conjunction with an Instrument ("Your Software"), and (iii) make one copy for archival and back-up purposes; (b) make and use copies of the Documentation; provided that such copies will be used only in connection with your licensed use of the Software Product, and such copies may not be republished or distributed (either in hard copy or electronic form) to any third party; and (c) copy, modify, enhance and prepare derivative works ("Derivatives") of the source code version of those portions of the Software Product set forth in and identified in the Documentation as "Samples" ("Sample Code") for the sole purposes of designing, developing, and testing Your Software. If you are an entity, only one designated individual within your organization, as designated by you, may exercise the License; provided that additional individuals within your organization may assist with respect to reproducing and distributing Sample Code as permitted under Section 1.1(c)(ii). LeCroy reserves all rights not expressly granted to you. No license is granted hereunder for any use other than that specified herein, and no license is granted for any use in combination or in connection with other products or services (other than Instruments and Your Software) without the express prior written consent of LeCroy. The Software Product is licensed as a single product. Its component parts may not be separated for use by more than one user. This EULA does not grant you any rights in connection with any trademarks or service marks of LeCroy. The Software Product is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The Software Product is licensed, not sold. The terms of this printed, paper EULA supersede the terms of any on-screen license agreement found within the Software Product.

1.2 Upgrades. If the Software Product is labeled as an "upgrade," (or other similar designation) the License will not take effect, and you will have no right to use or access the Software Product unless you are properly licensed to use a product identified by LeCroy as being eligible for the upgrade ("Underlying Product"). A Software Product labeled as an "upgrade" replaces and/or supplements the Underlying Product. You may use the resulting upgraded product only in accordance with the terms of this EULA. If the Software Product is an upgrade of a component of a package of software programs that you licensed as a single product, the Software Product may be used and transferred only as part of that single product package and may not be separated for use on more than one computer.

1.3. Limitations. Except as specifically permitted in this EULA, you will not directly or indirectly (a) use any Confidential Information to create any software or documentation that is similar to any of the Software Product or Documentation; (b) encumber, transfer, rent, lease, time-share or use the Software Product in any service bureau arrangement; (c) copy (except for archival purposes), distribute, manufacture, adapt, create derivative works of, translate, localize, port or otherwise modify the Software Product or the Documentation; (d) permit access to the Software Product by any party developing, marketing or planning to develop or market any product having functionality similar to or competitive with the Software Product; (e) publish benchmark results relating to the Software Product, nor disclose Software Product features, errors or bugs to third parties; or (f) permit any third party to engage in any of the acts proscribed in clauses (a) through (e). In jurisdictions in which transfer is permitted, notwithstanding the foregoing prohibition, transfers will only be effective if you transfer a copy of this EULA, as well as all copies of the Software Product, whereupon your right to use the Software product will terminate. Except as described in this Section 1.3, You are not permitted (i) to decompile, disassemble, reverse compile, reverse assemble, reverse translate or otherwise reverse engineer the Software Product, (ii) to use any similar means to discover the source code of the Software Product or to discover the trade secrets in the Software Product, or (iii) to otherwise circumvent any technological measure that controls access to the Software Product. You may reverse engineer or otherwise circumvent the technological

measures protecting the Software Product for the sole purpose of identifying and analyzing those elements that are necessary to achieve Interoperability (the "Permitted Objective") only if: (A) doing so is necessary to achieve the Permitted Objective and it does not constitute infringement under Title 17 of the United States Code; (B) such circumvention is confined to those parts of the Software Product and to such acts as are necessary to achieve the Permitted Objective; (C) the information to be gained thereby has not already been made readily available to you or has not been provided by LeCroy within a reasonable time after a written request by you to LeCroy to provide such information; (D) the information gained is not used for any purpose other than the Permitted Objective and is not disclosed to any other person except as may be necessary to achieve the Permitted Objective; and (E) the information obtained is not used (1) to create a computer program substantially similar in its expression to the Software Product including, but not limited to, expressions of the Software Product in other computer languages, or (2) for any other act restricted by LeCroy's intellectual property rights in the Software Product. "Interoperability" will have the same meaning in this EULA as defined in the Digital Millennium Copyright Act, 17 U.S.C. §1201(f), the ability of computer programs to exchange information and of such programs mutually to use the information which has been exchanged.

2. SUPPORT SERVICES. At LeCroy's sole discretion, from time to time, LeCroy may provide Updates to the Software Product. LeCroy shall have no obligation to revise or update the Software Product or to support any version of the Software Product. At LeCroy's sole discretion, upon your request, LeCroy may provide you with support services related to the Software Product ("Support Services") pursuant to the LeCroy policies and programs described in the Documentation or otherwise then in effect, and such Support Services will be subject to LeCroy's then-current fees therefor, if any. Any Update or other supplemental software code provided to you pursuant to the Support Services will be considered part of the Software Product and will be subject to the terms and conditions of this EULA. LeCroy may use any technical information you provide to LeCroy during LeCroy's provision of Support Services, for LeCroy's business purposes, including for product support and development. LeCroy will not utilize such technical information in a form that personally identifies you.

3. PROPRIETARY RIGHTS.

3.1 Right and Title. All right, title and interest in and to the Software Product and Documentation (including but not limited to any intellectual property or other proprietary rights, images, icons, photographs, text, and "applets" embodied in or incorporated into the Software Product, collectively, "Content"), and all Derivatives, and any copies thereof are owned by LeCroy and/or its licensors or third-party suppliers, and is protected by applicable copyright or other intellectual property laws and treaties. You will not take any action inconsistent with such title and ownership. This EULA grants you no rights to use such Content outside of the proper exercise of the license granted hereunder, and LeCroy will not be responsible or liable therefor.

3.2 Intellectual Property Protection. You may not alter or remove any printed or on-screen copyright, trade secret, proprietary or other legal notices contained on or in copies of the Software Product or Documentation.

3.3 Confidentiality. Except for the specific rights granted by this EULA, neither party shall use or disclose any Confidential Information (as defined below) of the other party without the written consent of the disclosing party. A party receiving Confidential Information from the other shall use the highest commercially reasonable degree of care to protect the Confidential Information, including ensuring that its employees and consultants with access to such Confidential Information have agreed in writing not to disclose the Confidential Information. You shall bear the responsibility for any breaches of confidentiality by your employees and consultants. Within ten (10) days after request of the disclosing party, and in the disclosing party's sole discretion, the receiving party shall either return to the disclosing party originals and copies of any Confidential Information and all information, records and materials developed therefrom by the receiving party, or destroy the same, other than such Confidential Information as to which this EULA expressly provides a continuing right to the receiving party to retain at the time of the request. Either party may only disclose the general nature, but not the specific financial terms, of this EULA without the prior consent of the other party; provided either party may provide a copy of this EULA to any finance provider in conjunction with a financing transaction, if such provider agrees to keep this EULA confidential. Nothing herein shall prevent a receiving party from disclosing all or part of the Confidential Information as necessary pursuant to the lawful requirement of a governmental agency or when disclosure is required by operation of law; provided that prior to any such disclosure, the receiving party shall use reasonable efforts to (a) promptly notify the disclosing party in writing of such requirement to disclose, and (b) cooperate fully with the disclosing party in protecting against any such disclosure or obtaining a protective order. Money damages will not be an adequate remedy if this Section 4.3 is breached and, therefore, either party shall, in addition to any other legal or equitable remedies, be entitled to seek an injunction or similar equitable relief against such breach or threatened breach without the necessity of posting any bond. As used herein, "Confidential Information" means LeCroy pricing or information concerning new LeCroy products, trade secrets (including without limitation all internal header information contained in or created by the Software Product, all benchmark and performance test results and all Documentation) and other proprietary information of LeCroy; and any business, marketing or technical information disclosed by LeCroy, or its representatives, or you in relation to this EULA, and either (i) disclosed in writing and marked as confidential at the time of disclosure or (ii) disclosed in any other manner such that a reasonable person would understand the nature and confidentiality of the information. Confidential Information does not include information (A) already in the possession of the receiving party without an obligation of confidentiality to the disclosing party, (B) hereafter rightfully furnished to the receiving party by a third party without a breach of any separate nondisclosure obligation to the disclosing party, (C) publicly known without breach of this EULA, (d) furnished by the disclosing party to a third party without restriction on subsequent disclosure, or (e) independently developed by the receiving party without reference to or reliance on the Confidential Information.

4. TERMINATION. This EULA will remain in force until termination pursuant to the terms hereof. You may terminate this EULA at any time. This EULA will also terminate if you breach any of the terms or conditions of this EULA. You agree that if this EULA terminates for any reason, the License will immediately terminate and you will destroy all copies of the Software Product (and all Derivatives), installed or otherwise, the Documentation, and the Confidential Information (and all derivatives of any of the foregoing) that

are in your possession or under your control. The provisions of Sections 1.3, 4, 6, 7, 8, and 9 will survive any termination or expiration hereof.

5. U.S. GOVERNMENT RESTRICTED RIGHTS. If any Software Product or Documentation is acquired by or on behalf of a unit or agency of the United States Government (any such unit or agency, the "Government"), the Government agrees that the Software Product or Documentation is "commercial computer software" or "commercial computer software documentation" and that, absent a written agreement to the contrary, the Government's rights with respect to the Software Product or Documentation are, in the case of civilian agency use, Restricted Rights, as defined in FAR §52.227.19, and if for Department of Defense use, limited by the terms of this EULA, pursuant to DFARS §227.7202. The use of the Software Product or Documentation by the Government constitutes acknowledgment of LeCroy's proprietary rights in the Software Product and Documentation. Manufacturer is LeCroy Corporation, 700 Chestnut Ridge Road, Chestnut Ridge, NY 10977 USA.

6. EXPORT RESTRICTIONS. You agree that you will not export or re-export the Software Product, any part thereof, or any process or service that is the direct product of the Software Product (the foregoing collectively referred to as the "Restricted Components"), to any country, person, entity or end user subject to U.S. export restrictions. You specifically agree not to export or re-export any of the Restricted Components (a) to any country to which the U.S. has embargoed or restricted the export of goods or services, which currently include, but are not necessarily limited to Cuba, Iran, Iraq, Libya, North Korea, Sudan and Syria, or to any national of any such country, wherever located, who intends to transmit or transport the Restricted Components back to such country; (b) to any end user who you know or have reason to know will utilize the Restricted Components in the design, development or production of nuclear, chemical or biological weapons; or (c) to any end-user who has been prohibited from participating in U.S. export transactions by any federal agency of the U.S. government. You warrant and represent that neither the BXA nor any other U.S. federal agency has suspended, revoked or denied your export privileges. It is your responsibility to comply with the latest United States export regulations, and you will defend and indemnify LeCroy from and against any damages, fines, penalties, assessments, liabilities, costs and expenses (including reasonable attorneys' fees and court costs) arising out of any claim that the Software Product, Documentation, or other information or materials provided by LeCroy hereunder were exported or otherwise accessed, shipped or transported in violation of applicable laws and regulations.

8. RISK ALLOCATION.

8.1 No Warranty. THE SOFTWARE PRODUCT IS NOT ERROR-FREE AND THE SOFTWARE PRODUCT AND SUPPORT SERVICES IS/ARE BEING PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND. LECROY, FOR ITSELF AND ITS SUPPLIERS, HEREBY DISCLAIMS ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO THE SOFTWARE PRODUCT OR ANY SUPPORT SERVICES INCLUDING, WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF TITLE OR NON-INFRINGEMENT, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY, INTEGRATION, VALIDITY, EXCLUSIVITY, MERCHANTABILITY, NON-INTERFERENCE WITH ENJOYMENT, FITNESS FOR ANY PARTICULAR PURPOSE, AND ALL WARRANTIES IMPLIED FROM ANY COURSE OF DEALING OR USAGE OF TRADE. YOU ACKNOWLEDGE THAT NO WARRANTIES HAVE BEEN MADE TO YOU BY OR ON BEHALF OF LECROY OR OTHERWISE FORM THE BASIS FOR THE BARGAIN BETWEEN THE PARTIES.

8.2. Limitation of Liability. LECROY'S LIABILITY FOR DAMAGES FOR ANY CAUSE WHATSOEVER, REGARDLESS OF THE FORM OF ANY CLAIM OR ACTION, SHALL NOT EXCEED THE GREATER OF THE AMOUNT ACTUALLY PAID BY YOU FOR THE SOFTWARE PRODUCT OR U.S.$5.00; PROVIDED THAT IF YOU HAVE ENTERED INTO A SUPPORT SERVICES AGREEMENT WITH LECROY, LECROY'S ENTIRE LIABILITY REGARDING SUPPORT SERVICES WILL BE GOVERNED BY THE TERMS OF THAT AGREEMENT. LECROY SHALL NOT BE LIABLE FOR ANY LOSS OF PROFITS, LOSS OF USE, LOSS OF DATA, INTERRUPTION OF BUSINESS, NOR FOR INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES OF ANY KIND, WHETHER UNDER THIS EULA OR OTHERWISE ARISING IN ANY WAY IN CONNECTION WITH THE SOFTWARE PRODUCT, THE DOCUMENTATION OR THIS EULA. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. THESE LIMITATIONS ARE INDEPENDENT FROM ALL OTHER PROVISIONS OF THIS EULA AND SHALL APPLY NOTWITHSTANDING THE FAILURE OF ANY REMEDY PROVIDED HEREIN.

8.3 Indemnification. You will defend, indemnify and hold harmless LeCroy and its officers, directors, affiliates, contractors, agents, and employees from, against and in respect of any and all assessments, damages, deficiencies, judgments, losses, obligations and liabilities (including costs of collection and reasonable attorneys' fees, expert witness fees and expenses) imposed upon or suffered or incurred by them arising from or related to your use of the Software Product.

9. GENERAL PROVISIONS.

9.1 Compliance with Laws. You will comply with all laws, legislation, rules, regulations, and governmental requirements with respect to the Software Product, and the performance by you of your obligations hereunder, of any jurisdiction in or from which you directly or indirectly cause the Software Product to be used or accessed.

9.2 No Agency. Nothing contained in this EULA will be deemed to constitute either party as the agent or representative of the other party, or both parties as joint venturers or partners for any purpose.

9.3 Entire Agreement; Waiver; Severability. This EULA constitutes the entire agreement between the parties with regard to the subject matter hereof. No provision of, right, power or privilege under this EULA will be deemed to have been waived by any act, delay, omission or acquiescence by LeCroy, its agents, or employees, but only by an instrument in writing signed by an authorized officer of

LeCroy. No waiver by LeCroy of any breach or default of any provision of this EULA by you will be effective as to any other breach or default, whether of the same or any other provision and whether occurring prior to, concurrent with, or subsequent to the date of such waiver. If any provision of this EULA is declared by a court of competent jurisdiction to be invalid, illegal or unenforceable, such provision will be severed from this EULA and all the other provisions will remain in full force and effect.

9.4 Governing Law; Jurisdiction; Venue. This EULA will be governed by and construed in accordance with the laws of the State of New York, USA, without regard to its choice of law provisions. The United Nations Convention on Contracts for the International Sale of Goods will not apply to this EULA. Exclusive jurisdiction and venue for any litigation arising under this EULA is in the federal and state courts located in New York, New York, USA and both parties hereby consent to such jurisdiction and venue for this purpose.

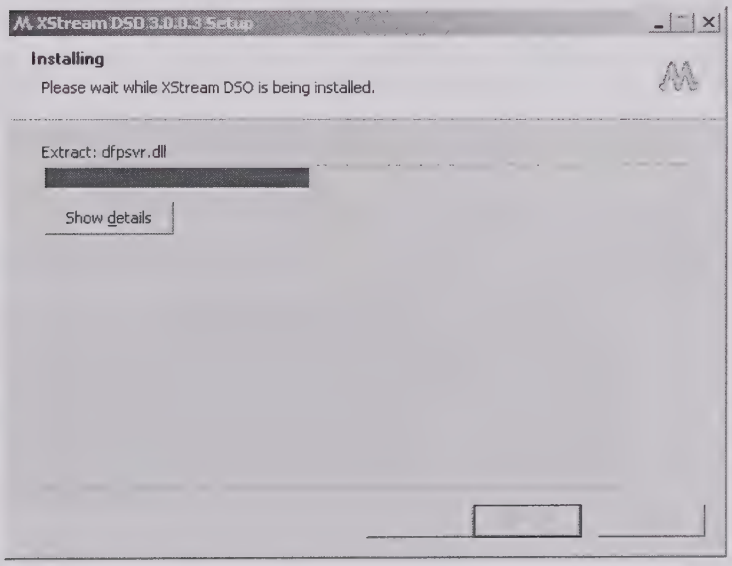
9.5 Assignment. This EULA and the rights and obligations hereunder, may not be assigned, in whole or in part by you, except to a successor to the whole of your business, without the prior written consent of LeCroy. In the case of any permitted assignment or transfer of or under this EULA, this EULA or the relevant provisions will be binding upon, and inure to the benefit of, the successors, executors, heirs, representatives, administrators and assigns of the parties hereto.

9.6 Notices. All notices or other communications between LeCroy and you under this EULA will be in writing and delivered personally, sent by confirmed fax, by confirmed e-mail, by certified mail, postage prepaid and return receipt requested, or by a nationally recognized express delivery service. All notices will be in English and will be effective upon receipt.

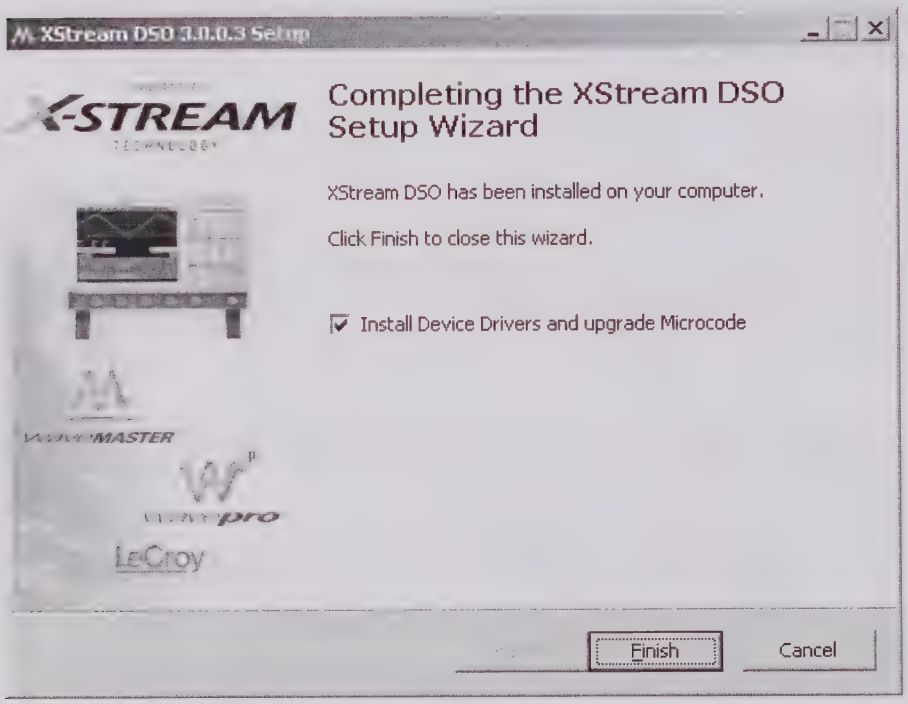
9.7 Headings. The headings used in this EULA are intended for convenience only and will not be deemed to supersede or modify any provisions.

9.8 Acknowledgment. Licensee acknowledges that (a) it has read and understands this EULA, (b) it has had an opportunity to have its legal counsel review this EULA, (c) this EULA has the same force and effect as a signed agreement, and (d) issuance of this EULA does not constitute general publication of the Software Product or other Confidential Information.

- Accept the agreement and press Next. The software installation process will begin and a progress bar will be displayed. Wait until completion.



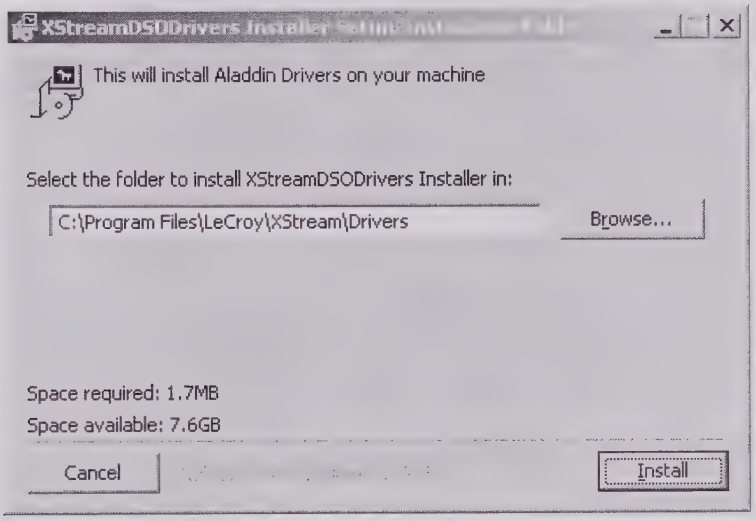
- At the completion on the software installation you will receive a dialog box as shown below:



- The check box should be checked to install the Windows device drivers and to upgrade the Microcode in the instrument.

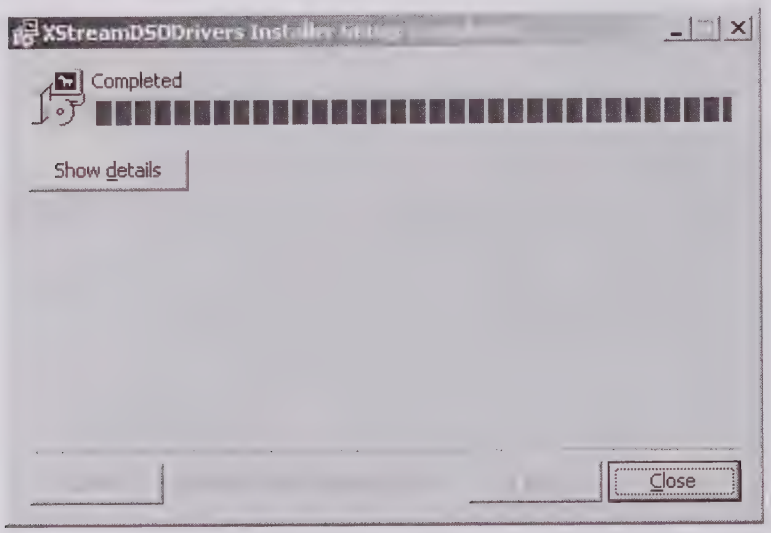
6.3.3 Installing Device Drivers

- Pressing finish will first install the device drivers. You will be prompted with a dialog box as shown below:



- Press Install, several new windows will open like shown below, it will take approximately 30 seconds for the drivers to be installed. A Found New Hardware Dialog Box may appear. DO NOT INTERVENE. The installer will automatically close this dialog box after a few seconds and the drivers will be installed.

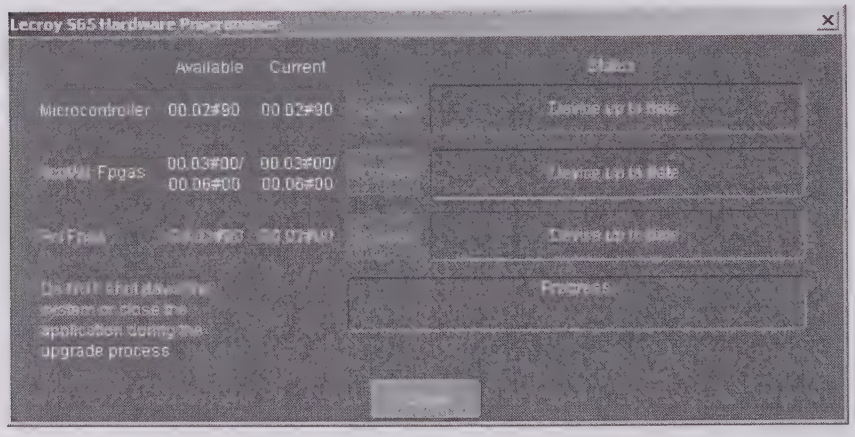
Several found new hardware boxes will momentarily appear, no intervention is required.



- After this is complete press close:

6.3.4 Upgrading Microcode

- Next the Hardware Programmer Dialog box will appear:



- If any update is required the update buttons will not be grayed out as shown above. Press one update button and wait for it to complete before pressing any other update buttons. **It is extremely important that this process not be interrupted while the parts are being programmed. Any interruption of power or interruption of the process may require that the instrument be returned to the factory for correction.**

- Once the update process is completed and no errors have been displayed, the power must then be cycled to invoke the new program settings. If no update was required then it is not necessary to cycle the power.
- The XStreamDSO application should automatically begin after power has been restored and after Windows has finished booting up. As the XstreamDSO application is launching the screen will appear as:

6.3.5 Verifying Microcode

If the version of the programmed hardware needs to be checked to see if it is at the correct revision for the software which is installed, the WavemasterHardwareProgrammer may be manually invoked by pressing Start, Programs, LeCroy, XStream, Service, hwprogrammer.exe. Follow the instructions list in section 6.3.3 above.

6.3.6 Software Options

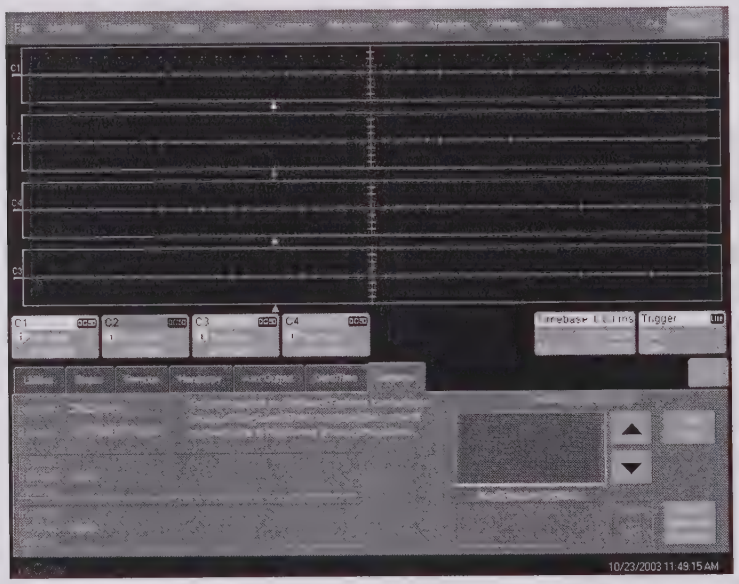
There are many software options available, new ones are being developed all of the time, refer to the LeCroy website for the latest selection of options available.

6.3.6.1 Changing Software Option Key

a. Scope ID, Scope Serial Number

The scope ID and scope s/n: are used to request a Software Option Key

- Enter the scope's Software Options menu (located under Utilities, Options)



.Note the **SCOPE ID**, i.e.: 12c5c6-a4 and **Scope s/n**: LCRY0601P10241 that are found on that menu.

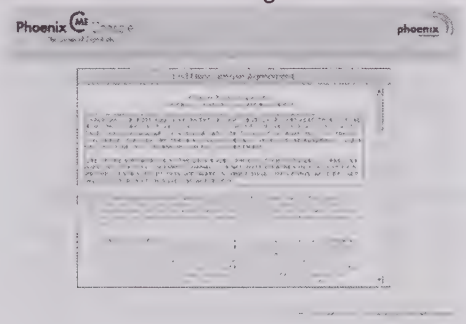
b. Entering Option Key in the DSO

- Enter the scope's Software Options menu (**Utilities, Options** menu).
- Press the **ADD KEY** button on the DSO touch screen
- Enter the new option key, i.e.: **5F4F-3184-2C81-8EF*8**
- Press **O.K.** to add the key
- Verify that the correct options are enabled (e.g. DDM2, JTA2, XMAP).

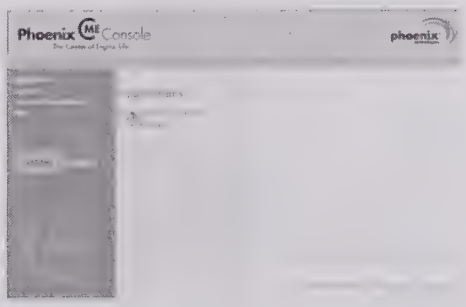
6.3.7 Restoring the Operating System

Your WaveSurfer Xs Series oscilloscope was designed to operate very reliably for many years. However, the application software does run on an internal hard drive. In the event of a hard disk problem, you may need to recover the application software on drive "C:" and/or the user data on drive "D:". Since WaveSurfer Xs Series does not have an installed CD-ROM drive, LeCroy has provided a recovery application program that will allow you to recover the application software and user data by accessing a partition on the hard drive. This is very easy to do, if necessary. Instructions are as follows:

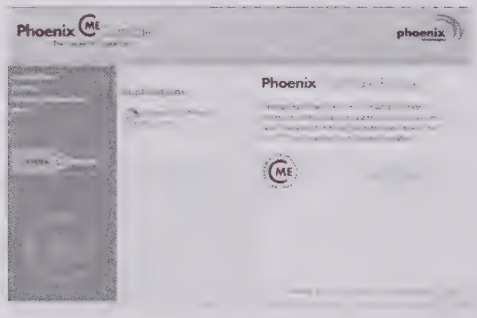
1. Connect a keyboard and a mouse to the WaveSurfer Xs Series.
2. Power the WaveSurfer Xs Series ON.
3. As soon as anything (logo, graphic, text) appears on the screen after boot-up, press and hold down the **F4** key.
4. The FirstWare cME console splash screen displays. Wait about 10 seconds.
5. The cME console End User License Agreement displays. There are [Accept] and [Decline] buttons at the end of this License Agreement. Click the [Accept] button.



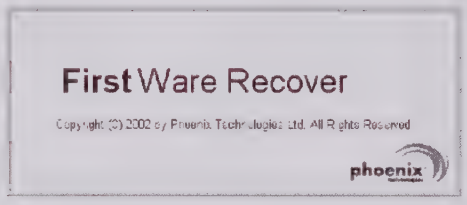
6. Phoenix cME Console main page displays. Click "Applications".
7. Click Phoenix FirstWare Recover. (If you click "SYSTEM RESTART" button, WaveSurfer Xs Series will reboot.)



8. Click the LAUNCH button.



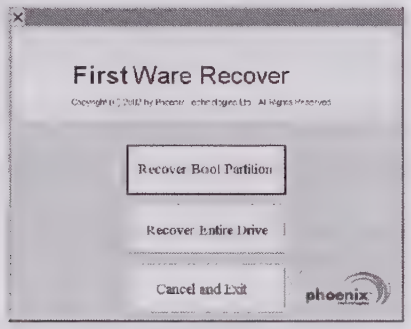
9. The First Ware Recover splash screen displays.



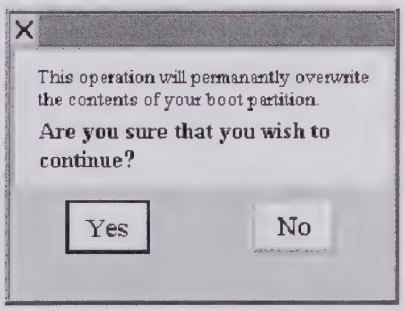
10. Read the license agreement and click [Accept] to proceed.

11. The Select Recover Type screen displays. Select recover option, as defined below:

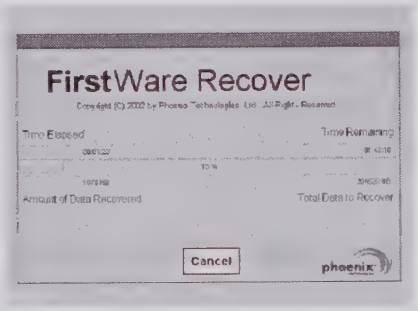
    [Recover Boot Partition] Recovers drive "C:" only. Drive “C:” is the drive that the WaveSurfer Xs Series application software is stored on. Drive "D:" is not recovered. (Drive "D:" is the USERDATA area of the hard disk.)
    [Recover Entire Drive] Select this button if you want to recover both the “C:” and “D:” drives of the hard disk (Note: Any USERDATA will be erased if this option is selected)



12. Read the license agreement and click [Accept] to proceed.
13. The following dialog box will be displayed. Click the [Yes] button.
    - When you select [Recover Boot Partition], the dialog message is “This operation will permanently overwrite the contents of your boot partition. Are you sure that wish to continue?”
    - When you select [Recover Entire Drive], the dialog message is “This operation will permanently overwrite the contents of your entire drive. Are you sure that wish to continue?”


This operation will permanently overwrite the contents of your boot partition.
Are you sure that you wish to continue?
Yes
No

14. The recovery starts, and the FirstWare Progress screen displays. No further selections are required. The recovery takes about 10 minutes.



15. When the recovery is completed, Windows will start automatically. No message or dialog box will display.
16. If you selected [Recover Entire Drive] in step 11, CheckDisk will run after the Windows splash screen.
17. After the "Welcome" screen, the FBReseal dialog box will display. Click the [OK] button. Windows will restart automatically.

6.4 Board Exchange Procedure

6.4.1 PCI Board Exchange Procedure

The WaveSurfer Xs Series uses option keys to identify the correct model number, memory size and software options. These option keys must be re-installed if the PCI board is exchanged..

7. Replaceable Parts

To order parts, contact your local LeCroy service office. A list of the service centers is given in section 2 of this manual. For boards, you can either order a new board or an exchange board. Exchange assemblies are factory repaired, inspected, tested and calibrated. If you order an exchange board, you must return the defective board.

This section applies to the following model:

WaveSurfer 64Xs, 62Xs, 44Xs,42Xs, 24Xs & 104Xs Mechanical & Electrical Replaceable Parts

Assembly	Description
	Scope Mechanical Assembly
	Acquisition Board Mechanical Assembly
	Front End Board Mechanical Assembly
913509-00	Accessories
903177-00	VST Board
913315-00	PCI Interface Board
913408-00	Front Panel Encoder/Keypad Board
914390-00	Display
913461-00	600 MHz 4ch Acquisition Board
913461-01	400 MHz 4ch Acquisition Board
913461-02	200 MHz 4ch Acquisition Board
914244-00	104Xs 4ch Acquisition Board
913791-01	400 MHz 2ch Acquisition Board
913791-00	600 MHz 2ch Acquisition Board
913462-00	600 MHz 4ch Front End Board
913792-00	600 MHz 2ch Front End Board
914243-00	1 GHz Front End Board
913212-01	Power Supply 24Xs-64Xs
914325-00	Power Supply 104Xs and Lbus model scopes
913342-00	PC mother board

7.1 Scope Mechanical Assy

Part Number	Qty	Description
227200012	1	Celeron Processor 1.2 GHz
330000008	1	Hard Drive 40GB 2.5 in
385020180	0	Insulating Film Kapton
519260005	1	Snap-In Open/Closed Bushing ID
554425003	2	Screw S/Tap Phil M2.5X6 Black
554430003	17	Screw S/Tap Phil M3x6
563430006	7	SCREW TX PAN M3X0.5-6MM S1
563430006	18	Screw TX PAN M3X0.5-6MM S1
563430006	6	SCREW TX PAN M3X0.5-6MM S1
563430106	7	SCREW TX ECO-FIX M3X0.5-6MM S1
594120003	5	Tiewrap
594120003	2	Tiewrap
594120006	5	Tiewrap
770200001	1	Phoenix First Ware Recovery
42258000001	1	DC to AC Inverter
42334740001	1	PC RAM 256 MB DIMM
42350480001	1	Gasket EMI Fabric 3x3mmx12.6in
42350480002	1	Gasket EMI Fabric 4mmx4mmx12.5
42377242001	1	MS XP Embedded License
42505000001	1	Heatsink Intel Socket 370
42519230002	2	Snap Rivet Nylon
42524105003	1	Standoff 6Hex M/F M3x23
42524105004	2	Standoff M/F 6Hex M3x15
42550000004	6	Screw pan HD Torx M3x22 w/patc
42550000008	4	Screw Pan HD Torx M3x4 w/patch
42551130100	5	Washer Flat M3 9mm OD
42555507001	2	Screw Self Tap Phil # 6-19 x 1
42575000001	8	Washer Silicone 2mm Thick
42592060001	2	3.0 Inch Cable Assy 50-Pos Rev
42771020001	1	Stylus Plastic - Palm M100
901582-01	5	WRXi Knob Small
901583-01	2	WRXi Knob Medium
901584-02	2	WRXi Knob Large
901887-00	1	Oscilloscope Backbone Licence
903118-00	1	Touchscreen Display Assembly
903177-00	1	WSXs VST PCA
913212-01	1	WSXs power supply
913310-00	1	WSXs Elastomeric Keymat
913315-00	1	PCI to Acq Interface Card
913321-00	1	WSXs Backlight Cable Assembl
913322-00	1	WSXs LCD Cable Assembly
913323-00	1	WSXs USB Cable Assembly
913324-00	1	Trigger / Ready and Trig Out Cable

Scope Mechanical Assy (con't)

Part Number	Qty	Description
913325-00	1	WSXs PCMB Encoder Cable Asse
913326-00	1	WSXs Power Switch Cable Asse
913330-00	1	WSXs Chassis Assy
913331-02	1	WSXs Back Cover
913332-00	1	WSXs Surfer IO Plate
913334-00	1	Acqusition Support Plate
913335-00	1	PCI Support Bracket
913336-00	1	Box Top Assy
913337-00	2	Foot Base
913338-00	2	Foot - Flipper
913339-00	2	WSXs Rear Foot
913342-00	1	PC Motherboard MX266-LC
913347-00	1	Front Frame
913351-01	1	WSXs Bezel
913368-00	1	WSXs FP EMI Shield
913369-00	1	WSXs Backlight Inverter Shie
913373-00	1	Hard Drive Cable Assembly
913461-00	1	600MHz/4ch Acq Assy
913461-01	1	400MHz/4ch Acq Assy
913462-00	1	600 MHz/4ch Front End Assy
913513-00	1	WSXs Surfer MB I/O Label
913521-02	1	WSXs Handle Assy Surfer
913530-00	1	WSXs Power Supply Hood
913531-01	1	Shipping Package - WSXs Surf
913563-01	1	Protective Cover WSXs Surfer
913575-00	1	WSXs 4ch Channel No Overlay
913576-00	1	Input Rating Overlay
913577-00	1	WSXs Prot. Cover Overlay
913585-00	12	Machine Screw M3 Flat Undercut
913585-00	3	Machine Screw M3 Flat Undercut
913590-00	2	WSXs Foot Spring
913620-00	1	WSXs 4 Ch Front Panel PCA
913620-01	1	WSXs 2 Ch Front Panel PCA
913788-00	1	WS 64Xs Model name Overlay
913789-00	1	WSXs 4 ch Front Panel Overlay
913791-00	1	600MHz/2ch Acq Assy
913791-01	1	400MHz/2ch Acq Assy
913792-00	1	600 MHz/2ch Front End Assy
913794-00	1	WSXs 2ch Channel No Overlay
913796-00	1	60mm Fan Assembly
913842-00	1	WSXs Surfer SN Label
913856-00	1	WSXs 2 ch Front Panel Overlay
913857-00	1	WS 62Xs Model name Overlay
913858-00	1	WS 44Xs Model name Overlay
913859-00	1	WS 42Xs Model name Overlay
913882-00	2	70 mm Fan Assembly

7.2 Acquisition Board Mechanical Assy

Part Number	Qty	Description
550010120	4	Screw Pan Head Phil M3X20 W/NY
563430006	4	SCREW TX PAN M3X0.5-6MM S1
709614330	4	HFE428 Heatsink
709614331	4	HFE428 Heatsink Clip
42507000002	2	Heatsink Assembly 70x70x40mm
42507000003	1	Heatsink Assembly 50x50x20mm
42551130100	4	Washer Flat M3 9mm OD
902528-00	6	Thermal Gap Pad Die-Cut
913346-00	1	WSXs Fan Tray
913450-00	1	WSXs MTT Coax Cable Assembly
913451-00	1	WSXs ADC1 Coax Cable Assembl
913452-00	1	WSXs ADC2 Coax Cable Assembl
913582-00	1	WSXs Acquisition Board PCA
913608-00	1	70 mm Fan Assembly
CH599041022	1	Heat Sink Compound 251

7.3 Front End Board Mechanical Assy

Part Number	Qty	Description
469040002	1	Metal Banana Jack/Binding Post
554425003	10	Screw S/Tap Phil M2.5X6 Black
555465002	1	Washer Lock Split 1/4
563430006	24	SCREW TX PAN M3X0.5-6MM S1
709614301	5	BNC Lock Washer
709614302	5	BNC Nut
42350480001	1	Gasket EMI Fabric 3x3mmx12.6in
42544220001	1	Spring Compression .31 in L
42550000003	18	Screw Pan HD Torx m3x10 w/pa
7093XXP41	5	Probe Holder
7093XXP91	5	Probe Ring Contact
913327-00	1	WSXs Main Card Panel
913353-00	2	Probus Cover
913354-00	1	Power Button
913374-00	1	Front End EMI Shield Top
913378-00	1	Front End EMI Shield Bottom
913379-00	6	Front End EMI Rib Top
913380-00	5	Front End EMI Rib Bottom
913570-00	1	EMI Rib Bottom Ext
913578-00	1	Main Card Panel Overlay
913597-00	1	WSXs FE PCA

7.4 Accessories

Part Number	Qty	Description
377000010	1	Lecroy Nist Calib Label
598761004	1	Resealable 2 Mil Bag 3 X 5
901477-00	1	LeCroy Blue Cal Void Sticker
901963-00	1	Ethernet Security Label
902006-00	1	LeCroy DSO Security Certificat
913812-00	1	WS Xs Access. Insert Sheet
913826-00	1	SW Option Manual CD in Sleeve
913939-00	1	WRXi_WRXs_VBAXi CECERT
CALIB-DE1	1	Calibration Document Envelope
GENCARD	1	REGISTRATION CARDS
GENCORD	1	POWERCORDS FROM ACC BOMS
GEN-GSG	1	Generic Getting Started Guide
GEN-QRG	1	Generic Quick Reference Guide
PP009-2	2	WSXs Surfer Dual Pack Probe

7.5 903177-00 – VST Board Electrical Parts

Part Number	Qty	Description
42SM207010001	1	IC LVDS FlatLink Receiver
42SM301001001	2	Ferrite Bead 60 Ohms 3A
42SM453020001	1	Conn PanelMate Hdr R/A 20-Pos
42SM453041001	1	Conn Recept Vert 41-Pos 1mm
42SM655031000	1	Res Thk Flm 1% 0 Ohm 1.0A
42SM655031097	5	Res Thk Film 1% 100 Ohm 1/10W
42SM662237102	6	Cap Cera 20% 25V 0.1uF X7R
42SM662247101	8	Cap Cera 20% 50V .01uF X7R
42SM662617101	2	Cap Cera 20% 10V 10uF X7R
913455-00	1	VST PCB
SM468969001	1	Test Point .150X.040X.090

7.6 913315-00 – PCI to ACQ Interface Board Electrical Parts

Part Number	Qty	Description
530040006	1	Buzzer 85DB 4 TO 7V
42454120002	1	Conn PC104 Socket Vert 120-Pos
42455910001	1	Conn PC104 Shroud Vert 120-Pos
42SM454050001	2	Conn Ejector Hdr Vert 50-Pos
42SM655031258	7	Res Thk Film 1% 4.75K Ohm 1/10
913559-00	1	WSXs PCI Card PCB
SM205108433	1	IC Eeprom 4K Bit W/ Serial Num
SM205717001	1	IC PAL PQ208 Plastic QFP
SM208540002	1	IC Adj Pos Volt Reg 3A LDO
SM236020050	1	Diode Rectifier 50V 1A
SM280120138	1	N Channel Pwr Mosfet BSS138LT
SM311200125	1	Gigabit Crystal Osc. 125Mhz
SM652061000	8	Res Chip 0 Ohm Jumper
SM652061103	1	Res Chip 1% 10K Ohm .063W
SM652061221	15	Res Chip 1% 220 Ohm .063W
SM652061240	1	Res Chip 1% 24.0 Ohm .063W
SM652061301	1	Res Chip 1% 300 Ohm .063W
SM655030037	47	Res Thk Film 1% 121 Ohm 1/16W
SM655030041	1	Res Thk Film 1% 53.6 Ohm 1/16W
SM661068104	43	Cap Cera Chip 0.1uF 0603
SM662232001	1	10000pf 0603 capacitor
SM666086022	4	Cap Mold Tant Chip 22 UF

7.7 913408-00 – Front Panel Encoder/Keypad Board Electrical Parts

Part Number	Qty	Description
42425100001	2	Encoder 20mm Detent
42425100003	7	Encoder 20mm Detent JOG PB
42SM202101001	1	IC Quad 2-In NAND Gate VHC00DR
42SM202101002	1	IC Hex CMOS Inverter 74VHC04D
42SM205035001	1	CPLD XC9572XL-10 10NS Delay
42SM208500001	1	Linear CMOS Reg 300mA LP3982
42SM208500002	1	IC Reset TPS3809K33
42SM227039001	1	IC 16-Bit Microcomputer USB
42SM230000001	17	Diode Triple Switching BAS16VY
42SM256000001	1	Diode LED SP Red 2mm
42SM256000003	1	Diode LED SP Yellow 2mm
42SM256000004	10	Diode LED Aqua Green 2mm
42SM256000005	1	Diode LED SP Blue 2mm
42SM270090001	5	Transistor NPN BRT MUN5211T1G
42SM275000001	5	Transistor PNP BRT MUN5111T1G
42SM310900001	1	Crystal 24 MHz FPXLF
42SM453003003	1	Conn Hdr Vert 3-Pos Shrouded
42SM453004001	1	Conn FFC-FPC R/A 4-Pos ZIF
42SM453005003	1	Conn Hdr Vert 5-Pos Shrded 1.5
42SM453006002	1	Conn Hdr Vert 6-Pos Shrouded
42SM453014001	1	Conn Hdr Vert 14-Pos Shrouded
42SM453020001	1	Conn PanelMate Hdr R/A 20-Pos
42SM453020002	1	Conn Hdr Vert 20-Pos 1.25mm
42SM655031038	2	Res Thk Film 1% 24.3 Ohm 1/10W
42SM655031101	5	Res Thk Film 1% 110 Ohm 1/10W
42SM655031147	9	Res Thk Film 1% 332 Ohm 1/10W
42SM655031164	3	Res Thk Film 1% 499 Ohm 1/10W
42SM655031193	3	Res Thk Film 1% 1K Ohm 1/10W
42SM655031258	12	Res Thk Film 1% 4.75K Ohm 1/10
42SM655031289	42	Res Thk Film 1% 10K Ohm 1/10W
42SM655031322	7	Res Thk Flm 1% 22.1K Ohm 1/10W
42SM655031385	3	Res Thk Film 1% 100K Ohm 1/10W
42SM662117102	9	Cap Cera 20% 10V 0.1uF X7R
42SM662127101	10	Cap Cera 20% 16V .01uF X7R
42SM662135001	2	Cap Cera 5% 25V 10pF NPO
42SM662637101	2	Cap Cera 20% 25V 2.2uF X7R
913688-00	1	WSXs Surfer Front Panel PCB
SM468969001	2	Test Point .150X.040X.090

7.8 913582-00 – Acquisition Board Electrical Parts

Part Number	Qty	Description
454000018	1	Hdr Sold Tail Male 18 Pin HI T
454016002	1	Conn Hdr Vert 16 Pos Wire-BD
454022001	1	HEADER VERT 22 POS WIRE BD
591002130	3	Wire Tef Blk Solid Awg 30
42454004003	1	Conn Hdr Vert 4-Pos 2.54mm
42554430100	8	Standoff Press-Fit M3x3mm
42594200001	2	Heatsink Clip Solder Anchor
42SM145433001	2	Cap Alum Elec 20% 1000uF/25V
42SM202021001	3	IC Dual Retrig Mono/Multivib
42SM202024001	1	IC Hex Schmitt-Trig Inv 74HC14
42SM205021001	1	IC 256K X 16 Async SRAM 55ns
42SM205036001	1	IC FPGA XC3S100E-VQ100
42SM206007001	7	IC Quad Bus Buffer w/3-State
42SM206088001	5	IC CMOS Hi-Spd Analog Mux/DeMu
42SM206090002	2	IC SMBus PWM Fan Speed Control
42SM208450001	1	IC Voltage Ref 4.096V 5ppm
42SM208500002	1	IC Reset TPS3809K33
42SM270130001	2	Transistor NPN MMBT2222ALT1G
42SM301001007	13	Ferrite Bead 220 Ohm 2A
42SM301001011	3	Inductor Power SMT 5.6uH 4A
42SM311000003	1	Crystal Osc XO 10MHz Y1600
42SM453002002	2	Conn Hdr Vert 2-Pos Shrouded
42SM453003003	1	Conn Hdr Vert 3-Pos Shrouded
42SM453005003	1	Conn Hdr Vert 5-Pos Shrded 1.5
42SM453006002	1	Conn Hdr Vert 6-Pos Shrouded
42SM454050001	2	Conn Ejector Hdr Vert 50-Pos
42SM454050002	5	Conn Hi-Spd Socket Vert 50-Pos
42SM655021000	15	Res Thk Film 1% 0 Ohm 1.0A
42SM655021105	66	Res Thk Film 1% 121 Ohm 1/16W
42SM655021120	4	Res Thk Film 1% 174 Ohm 1/16W
42SM655021130	50	Res Thk Film 1% 221 Ohm 1/16W
42SM655021154	7	Res Thk Flm 1% 392 Ohm 1/16W
42SM655021193	9	Res Thk Flm 1% 1K Ohm 1/16W
42SM655021200	16	Res Thk Flm 1% 1.18K Ohm 1/16W
42SM655021222	7	Res Thk Flm 1% 2K Ohm 1/16W
42SM655021261	7	Res Thk Flm 1% 5.11K Ohm 1/16W
42SM655021277	8	Res Thk Flm 1% 7.5K Ohm 1/16W
42SM655021289	10	Res Thk Film 1% 10K Ohm 1/16W
42SM655031000	7	Res Thk Flm 1% 0 Ohm 1.0A
42SM655031062	7	Res Thk Flm 1% 43.2 Ohm 1/10W
42SM655031077	8	Res Thk Film 1% 61.9 Ohm 1/10W
42SM655031097	16	Res Thk Film 1% 100 Ohm 1/10W
42SM655031126	1	Res Thk Flm 1% 200 Ohm 1/10W

913582-00 – Acquisition Board Electrical Parts (con't)

Part Number	Qty	Description
42SM655031181	1	Res Thk Flm 1% 750 Ohm 1/10W
42SM655031193	21	Res Thk Film 1% 1K Ohm 1/10W
42SM655031222	36	Res Thk Flm 1% 2K Ohm 1/10W
42SM655031239	7	Res Thk Flm 1% 3.01K Ohm 1/10W
42SM655031243	5	Res Thk Flm 1% 3.32K Ohm 1/10W
42SM655031251	3	Res Thk Flm 1% 4.02K Ohm 1/10W
42SM655031289	40	Res Thk Film 1% 10K Ohm 1/10W
42SM655031300	4	Res Thk Flm 1% 13K Ohm 1/10W
42SM655031318	15	Res Thk Flm 1% 20K Ohm 1/10W
42SM655031357	3	Res Thk Film 1% 51.1K Ohm 1/10
42SM655031365	5	Res Thk Flm 1% 61.9K Ohm 1/10W
42SM655033001	7	Res Thk Film 5% 0.33 Ohm 1/10W
42SM655041147	3	Res Thk Film 1% 332 Ohm 1/8W
42SM655041154	19	Res Thk Film 1% 392 Ohm 1/8W
42SM655041586	2	Res Thk Film 1% 1.21 ohm 1/8W
42SM662117102	45	Cap Cera 20% 10V 0.1uF X7R
42SM662145001	28	Cap Cera 5% 50V 390pF C0G
42SM662145002	8	Cap Cera 5% 50V 82pF C0G
42SM662237102	93	Cap Cera 20% 25V 0.1uF X7R
42SM662247101	10	Cap Cera 20% 50V .01uF X7R
42SM662317101	6	Cap Cera 20% 10V 1.0uF X7R
42SM662617101	39	Cap Cera 20% 10V 10uF X7R
913411-00	3	WSXs Clock EMI Shield
913435-00	1	WSXs Main Acq Card PCB
HAD639C-02	2	Packaged MAD440E 10GS/s SiGe
HFE444	4	Hybrid Dso Front End 1GHZ
HTT660	1	Trigger and Timebase
MAM439	6	Monolithic 8 Megabyte Dram Mem
SM185457201	1	Res Vari Cermet 200 Ohms
SM200178074	1	IC D-Typ Flop 74HCT74
SM200180032	1	IC 2-in OR Gate 74VHC1G32
SM201174011	2	IC Ecl 1:2 Diff Clock Drvr 10E
SM201570016	1	IC Ecl Diff Receiver 10EL16D
SM201774025	1	Diff Ecl-Ttl Transl 10ELT25
SM202100004	1	IC PLL Freq Synth 4106 6 GHz
SM205129160	1	IC FLASH MEM 16 MBIT HY29LV160
SM205200002	1	IC 8M x 8 Bit 133MHz SDRAM
SM205715003	1	IC PAL FG456 Fine-Pitch BGA
SM206370024	3	IC Ttl TO Diff Ecl Transl MC10
SM207010002	1	IC CMOS 8 BIT LOW RES BUS SWIT
SM207010011	1	IC Quad 10-Bit DAC LTC1664
SM207010014	1	16 Bit Buffer/Driver 3-State
SM207010029	1	IC 16-Bit Octal DAC R/R LTC260
SM208400001	3	IC MMIC Amplifier 12GHz NBB-30

913582-00 – Acquisition Board Electrical Parts (con't)

Part Number	Qty	Description
SM208400002	1	IC MMIC Amplifier 8GHz NBB-400
SM208470353	8	IC Dual OP Amp LF353
SM208472022	2	Opamp Dual Low Pwr TLE2022C
SM208476482	2	IC Dual OP Amp Rail TO Rail 64
SM208550004	7	IC Volt Reg Pos Adjust LDO
SM208701023	1	IC Temperature Sensor
SM208870339	1	IC Volt Comparator 339
SM208909850	1	DDS-125MHZ Cmos Synth AD9850
SM227110161	1	16 BIT MICROCONTROLLER C161PI
SM232022824	1	Diode Array Schottky HSMS2824
SM236030099	2	Diode SO-Pkg BAV99
SM256232013	1	Diode Light Emitting Red
SM270130092	4	Transistor Npn BFR92A
SM270330848	3	Transistor Npn BC848C
SM275132907	2	Transistor Pnp 2907A
SM281115003	3	P-CH Hdtmos Pwr E-Fet MTB50P03
SM300092390	1	Inductor Wound 2% 39 NH
SM300600009	2	Inductor 9.3uH 7.2A Wound
SM300600012	2	Inductor 150nH 5% Wound
SM301001001	18	BEAD FERRITE
SM301001002	6	Bead SHF 0.3A
SM301001016	4	Inductor Pwr Toroid 272uH .36A
SM301001017	3	Inductor Chip 10% 15uH 1210
SM301001018	1	Inductor Shielded 100uH 10%
SM301004001	18	Bead Ferrite 50 Ohms 3AMPS 120
SM311000005	1	Crystal Oscillator 16 MHz 3.3V
SM311000006	1	Voltage Controlled Oscillator
SM468969001	10	Test Point .150X.040X.090
SM507000002	2	Heatsink Surface Mount TO-263
SM651081102	6	Res Chip 0.1% 1 Kohm
SM652041000	2	Res Zero ohms
SM652041011	24	Res Chip 1% 49.9 Ohms
SM652041200	10	Res 20 Ohms +/-1% 1/16W 0402 S
SM652061100	2	Res Chip 1% 10.0 Ohm .063W
SM652061101	2	Res Chip 1% 100 Ohm .063W
SM652061102	10	Res Chip 1% 1.0K Ohm .063W
SM652061105	1	Res Chip 1% 1.0M Ohm .063W
SM652061200	1	Res Chip 1% 20.0 Ohm .063W
SM652061221	2	Res Chip 1% 220 Ohm .063W
SM652061222	1	Res Chip 1% 2.2K Ohm .063W
SM652061240	1	Res Chip 1% 24.0 Ohm .063W
SM652061271	2	Res Chip 1% 270 Ohm .063W
SM652061271	1	Res Chip 1% 270 Ohm .063W

913582-00 – Acquisition Board Electrical Parts (con't)

Part Number	Qty	Description
SM652061332	7	Res Chip 1% 3.3K Ohm .063W
SM652061334	1	Res Chip 1% 330K Ohm .063W
SM652061393	1	Res Chip 1% 39K Ohm .063W
SM652061510	12	Res Chip 1% 51.0 Ohm .063W
SM652061511	2	Res Chip 1% 510 Ohm .063W
SM653101226	1	Res Chip 1% 18.2 Ohms
SM653101285	7	Res Chip 1 % 75.0 Ohms
SM653101297	9	Res Chip 1% 100 Ohms
SM653101322	2	Res Chip 1% 182 Ohms
SM653101326	7	Res Chip 1% 200 Ohms
SM653101334	6	Res Chip 1% 243 Ohms
SM653101377	5	Res Chip 1% 681 Ohms
SM653101393	7	Res Chip 1% 1.00 K
SM653101401	3	Res Chip 1% 1.21 K
SM653101410	13	Res Chip 1% 1.50 K
SM653101422	6	Res Chip 1% 2.00 K
SM653101426	3	Res Chip 1 % 2.21K
SM653101458	6	Res Chip 1 % 4.75 K
SM653101461	1	Res Chip 1% 5.11 K
SM653101489	9	Res Chip 1 % 10.0 K
SM653101539	4	Res Chip 1% 33.2 K
SM653125047	7	Res Thick Film 5% 4.7 Ohms
SM654101000	11	Chip Jumper Zero Ohms
SM655020021	8	Res Thk Film 5% 10 Ohm 1/16W
SM655020025	16	Res Thk Film 1% 2.74 Ohm 1/16W
SM655080004	1	Res Thk Film 1 Ohm +/- 5% 1/2W
SM655080005	8	Res Thk Film 1% 105 Ohm 1/2W
SM661010002	6	Cap Cera Chip 27PF +/- 5%
SM661045150	4	Cap 15PF +/-5% 50V Smt Npo 040
SM661066102	16	Cap Cera Chip 10% 1000PF/50V
SM661068104	16	Cap Cera Chip 0.1uF 0603
SM661073331	3	Cap Cera 330PF+/- 5% 50V Npo
SM661073820	7	Cap Cera 82PF+/- 5% 50V Npo
SM661165102	3	Cap Cera Chip 1000PF
SM661207103	3	Cap Cera Chip 20% .01 UF
SM661207104	145	Cap Cera Chip 20 % .1 UF
SM661255015	1	Cap Cera Chip 1.5 PF
SM661255121	2	Cap Cera Chip 5% 120 PF
SM662111002	78	Cap Cera Chip 1000pF 5% 25V
SM662130001	8	Cap Cera 3.0pF 50V +/-.25%
SM662135002	16	Cap Cera +/-.1pF 50V 1.0pF NPO
SM662151001	12	Cap Cera Chip 10% 16V 0.1 UF
SM662152001	16	Cap Cera Chip 10% 16V 100nF
SM662232001	8	10000pf 0603 capacitor

913582-00 – Acquisition Board Electrical Parts (con't)

Part Number	Qty	Description
SM662432001	1	Cap Cera 4700pF 10% 50V X7R
SM662432002	1	Cap Cera Chip 0.22uF 10% 50V
SM662913001	53	Cap Cera Chip 10uF 20% 25V X5R
SM666267227	22	Cap Tant 220UF 10V 20%
SM669049003	16	Inductor 3.3nH +/-5%
SM669117001	16	Inductor Chip 2.2uH 20% 350mA

7.9 913597-00 – Front End Board Electrical Parts

Part Number	Qty	Description
416162005	1	Switch R/A PCB Mtg SPDT MOM
454004002	1	Conn Receptacle USB R/A 4 Pos
42405100001	1	PC Screw Terminal M3
42SM158022001	9	Cap Variable-Trimmer 4 - 25 pF
42SM158022002	5	Cap Variable-Trimmer 1.4-3 pF
42SM158022003	4	Cap Variable-Trimmer 2 - 6 pF
42SM180094001	4	IC Trimming Pot 200 Ohm
42SM180193002	4	IC Trimming Pot 5K Ohm ST4EA
42SM192413001	10	Thermal Sensor 1% 2K Ohm 1/32W
42SM192439001	4	Thermistor NTC 5% 220 Ohm
42SM202026001	1	IC CMOS 2-Ch Mux/Demux TC4W53F
42SM202060001	5	IC 2-Input OR Gate 74HCT1G32
42SM205024001	10	IC 8-Bit Shift Reg 3-State 74H
42SM208240001	1	IC Dual Op Amp TA75S558F
42SM230000001	33	Diode Triple Switching BAS16VY
42SM230500001	5	Diode Switching HSM124S
42SM230900001	33	Diode Hi-Speed Switching 1SS35
42SM230900002	1	Diode Hi-Speed Switching 1SS26
42SM240710001	5	Diode Zener 4.7V RD4.7S
42SM270690002	5	Transistor NPN 2SC4228
42SM270690003	10	Transistor NPN 2SC4227 R34
42SM270990001	5	Transistor NPN 2SC3583 R34
42SM275000001	5	Transistor PNP BRT MUN5111T1G
42SM275690002	15	Transistor PNP 2SA1586
42SM280000002	5	Transistor JFET N-Ch 2SK508-K5
42SM289210001	9	Transistor NPN/PNP PIMD3
42SM289210002	44	Transistor NPN/PNP UMZ1N
42SM289318001	4	Transistor HJ-FET N-Ch NE34018
42SM301001001	6	Ferrite Bead 60 Ohms 3A
42SM301001002	4	Inductor Chip 10nH 5%
42SM301001003	4	Inductor Chip 12nH 5%
42SM301001004	5	Inductor Chip 15nH 5%
42SM301001006	1	Inductor Chip 8.2nH 5%
42SM301001007	25	Ferrite Bead 220 Ohm 2A
42SM301001008	91	Ferrite Bead 600 Ohm 100mA
42SM430920003	5	Relay 2-Contact 1A 4.5V G6K-2F
42SM430920004	26	Relay 2-Contact 1A 4.5V G6KU-2
42SM453005003	1	Conn Hdr Vert 5-Pos Shrded 1.5
42SM453050001	5	Conn Hdr R/A 50-Pos 0.635mm
42SM655021289	88	Res Thk Film 1% 10K Ohm 1/16W
42SM655031000	19	Res Thk Flm 1% 0 Ohm 1.0A
42SM655031001	4	Res Thk Film 1% 10 Ohm 1/10W
42SM655031034	9	Res Thk Film 1% 22.1 Ohm 1/10W
42SM655031038	9	Res Thk Film 1% 24.3 Ohm 1/10W

913597-00 – Front End Board Electrical Parts (con't)

Part Number	Qty	Description
42SM655031042	2	Res Thk Film 1% 26.7 Ohm 1/10W
42SM655031047	4	Res Thk Film 1% 30.1 Ohm 1/10W
42SM655031051	20	Res Thk Film 1% 33.2 Ohm 1/10W
42SM655031066	6	Res Thk Film 1% 47.5 Ohm 1/10W
42SM655031069	10	Res Thk Film 1% 51.1 Ohm 1/10W
42SM655031077	5	Res Thk Film 1% 61.9 Ohm 1/10W
42SM655031081	1	Res Thk Film 1% 68.1 Ohm 1/10W
42SM655031085	8	Res Thk Film 1% 75 Ohm 1/10W
42SM655031097	26	Res Thk Film 1% 100 Ohm 1/10W
42SM655031105	9	Res Thk Film 1% 121 Ohm 1/10W
42SM655031108	9	Res Thk Film 1% 130 Ohm 1/10W
42SM655031114	5	Res Thk Film 1% 150 Ohm 1/10W
42SM655031122	8	Res Thk Film 1% 182 Ohm 1/10W
42SM655031126	2	Res Thk Flm 1% 200 Ohm 1/10W
42SM655031130	9	Res Thk Film 1% 221 Ohm 1/10W
42SM655031143	4	Res Thk Film 1% 301 Ohm 1/10W
42SM655031147	8	Res Thk Film 1% 332 Ohm 1/10W
42SM655031154	11	Res Thk Film 1% 392 Ohm 1/10W
42SM655031158	5	Res Thk Film 1% 432 Ohm 1/10W
42SM655031162	4	Res Thk Film 1% 475 Ohm 1/10W
42SM655031177	5	Res Thk Film 1% 681 Ohm 1/10W
42SM655031193	35	Res Thk Film 1% 1K Ohm 1/10W
42SM655031197	9	Res Thk Film 1% 1.1K Ohm 1/10W
42SM655031204	4	Res Thk Film 1% 1.3K Ohm 1/10W
42SM655031210	1	Res Thk Film 1% 1.5K Ohm 1/10W
42SM655031213	6	Res Thk Film 1% 1.62K Ohm 1/10
42SM655031218	5	Res Thk Flm 1% 1.82K Ohm 1/10W
42SM655031222	5	Res Thk Flm 1% 2K Ohm 1/10W
42SM655031226	7	Res Thk Flm 1% 2.21K Ohm 1/10W
42SM655031234	2	Res Thk Flm 1% 2.67K Ohm 1/10W
42SM655031235	1	Res Thk Flm 1% 2.74K Ohm 1/10W
42SM655031239	1	Res Thk Flm 1% 3.01K Ohm 1/10W
42SM655031250	5	Res Thk Flm 1% 3.92K Ohm 1/10W
42SM655031277	10	Res Thk Film 1% 7.5K Ohm 1/10W
42SM655031289	18	Res Thk Film 1% 10K Ohm 1/10W
42SM655031314	1	Res Thk Flm 1% 18.2K Ohm 1/10W
42SM655031335	5	Res Thk Film 1% 30.1K Ohm 1/10
42SM655031357	9	Res Thk Film 1% 51.1K Ohm 1/10
42SM655031381	8	Res Thk Film 1% 90.9K Ohm 1/10
42SM655031385	24	Res Thk Film 1% 100K Ohm 1/10W
42SM655031393	6	Res Thk Film 1% 121K Ohm 1/10W
42SM655031422	4	Res Thk Film 1% 243K Ohm 1/10W
42SM655031561	5	Res Thk Film 1% 6.81M Ohm 1/10

913597-00 – Front End Board Electrical Parts (con't)

Part Number	Qty	Description
42SM655040001	50	Res Thn Film 0.5% 20 Ohm 1/10W
42SM655040002	9	Res Thn Flm 0.1% 110K Ohm 1/10
42SM655040003	1	Res Thn Flm 0.1% 200K Ohm 1/10
42SM655040003	18	Res Thn Flm 0.1% 200K Ohm 1/10
42SM655040004	29	Res Thn Flm 0.1% 300K Ohm 1/10
42SM655040005	4	Res Thn Flm 0.1% 430K Ohm 1/10
42SM655040006	4	Res Thn Flm 0.1% 470K Ohm 1/10
42SM662117102	1	Cap Cera 20% 10V 0.1uF X7R
42SM662225001	10	Cap Cera 5% 16V 100pF NPO
42SM662226201	13	Cap Cera 10% 16V 1.0uF X5R
42SM662237102	93	Cap Cera 20% 25V 0.1uF X7R
42SM662246001	5	Cap Cera 10% 50V .033uF X7R
42SM662247101	60	Cap Cera 20% 50V .01uF X7R
42SM662575001	5	Cap Cera 5% 500V 27pF NPO
42SM662579001	5	Cap Cera +/-.25pF 500V 1pF NPO
42SM662579901	5	Cap Cera +/-.25pF 500V 5.0pF C
42SM662592101	4	Cap Cera 10% 250V 4700pF X7R
42SM662599101	5	Cap Cera 15% 630V 2200pF X7R
42SM662617101	3	Cap Cera 20% 10V 10uF X7R
7093XXP01	5	Right Angle Recept. Connector
7093XXP21	5	Bulkhead Receptacle Female Bnc
913405-00	4	Relay Shield
913586-00	1	Cal Probe Hook
913589-00	1	WSXs FE PCB
SM202057002	1	IC Triple 2-CH Analog Mux
SM207944351	1	OCTAL ANALOG MUX/DEMUX 74HCT43
SM208470353	4	IC Dual OP Amp LF353
SM208470705	6	IC OP Amp Picoamp Input AD705
SM208472022	1	Opamp Dual Low Pwr TLE2022C
SM468969001	10	Test Point .150X.040X.090
SM652061103	1	Res Chip 1% 10K Ohm .063W
SM653101322	4	Res Chip 1% 182 Ohms
SM661066102	85	Cap Cera Chip 10% 1000PF/50V
SM661073005	4	Cap Cera 0.5+/- 0.1PF 50V Npo
SM661073010	9	Cap Cera 1.0 +/-0.1PF 50V Npo
SM661073020	16	Cap Cera 2.0+/- 0.1PF 50V Npo
SM661073030	4	Cap Cera 3.0+/- 0.1PF 50V Npo
SM661073039	10	Cap Cera 3.9+/- 0.1PF 50V Npo
SM661073051	4	Cap Cera 5.1+/- 0.1PF 50V Npo
SM661073062	9	Cap Cera 6.2+/- 0.1PF 50V Npo
SM661073270	4	Cap Cera 27PF+/- 5% 50V Npo
SM661207104	1	Cap Cera Chip 20 % .1 UF
SM662230002	1	Capacitor 1.5PF+/-0.05PF 50V
SM662913001	10	Cap Cera Chip 10uF 20% 25V X5R

This page intentionally left blank

8. Mechanical Parts

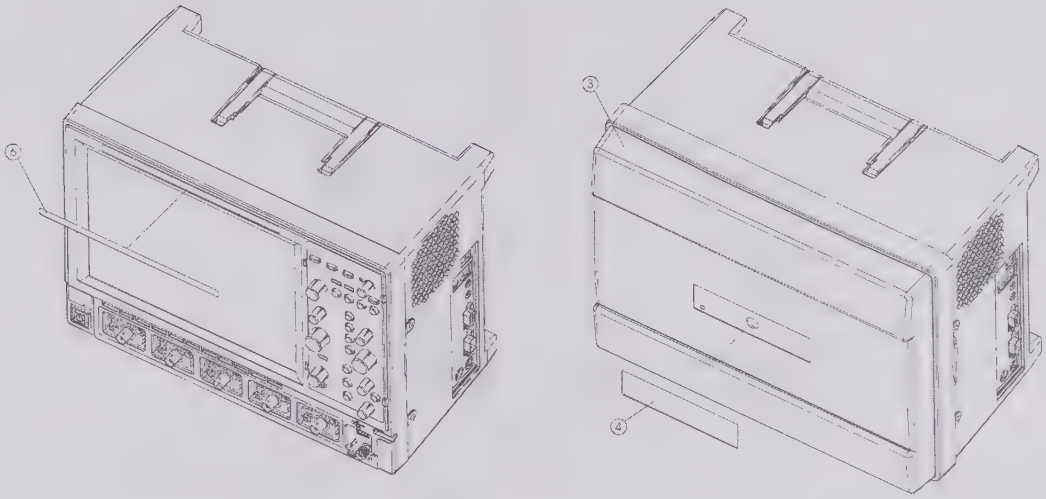


Figure 8-1 WaveSurfer Xs Scope

Item	Part Number	Qty	Description
3	913563-01	1	WSXs Protective Cover
4	913577-00	1	WSXs Prot. Cover Overlay
6	913857-00	1	WS 62Xs Model name Overlay
	913858-00	1	WS 44Xs Model name Overlay
	913859-00	1	WS 42Xs Model name Overlay
	913788-00	1	WS 64Xs Model name Overlay

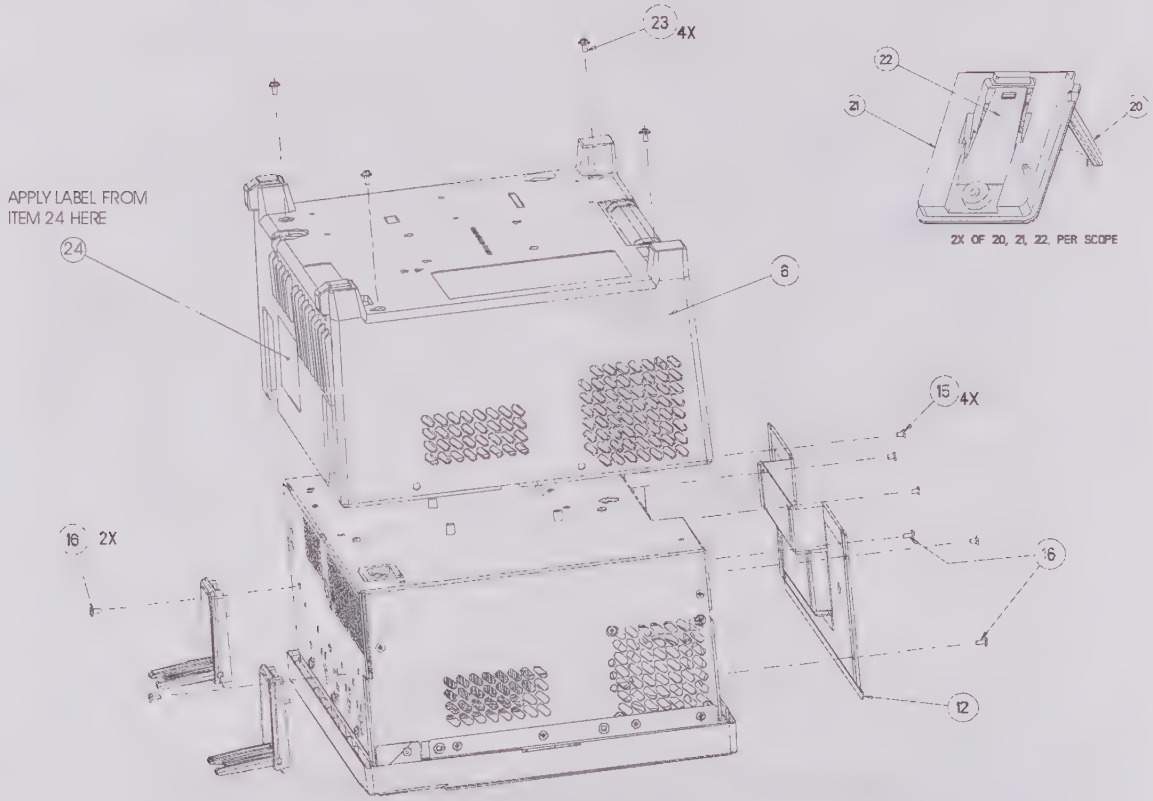


Figure 8-2 Installation of Back Shell

Item	Part Number	Qty	Desciption
6	913469-02	1	Back Assy - WSXs S
12	913336-00	1	Box Top Assy
15	913585-00	4	Machine Screw M3 Flat Undercut
16	563430006	4	SCREW TX PAN M3X0.5-6MM S1
20	913338-00	2	Foot - Flipper
21	913337-00	2	Foot Base
22	913590-00	2	WSXs Foot Spring
23	563430106	4	SCREW TX ECO-FIX M3X0.5-6MM S1
24	42377242001	1	MS XP Embedded License

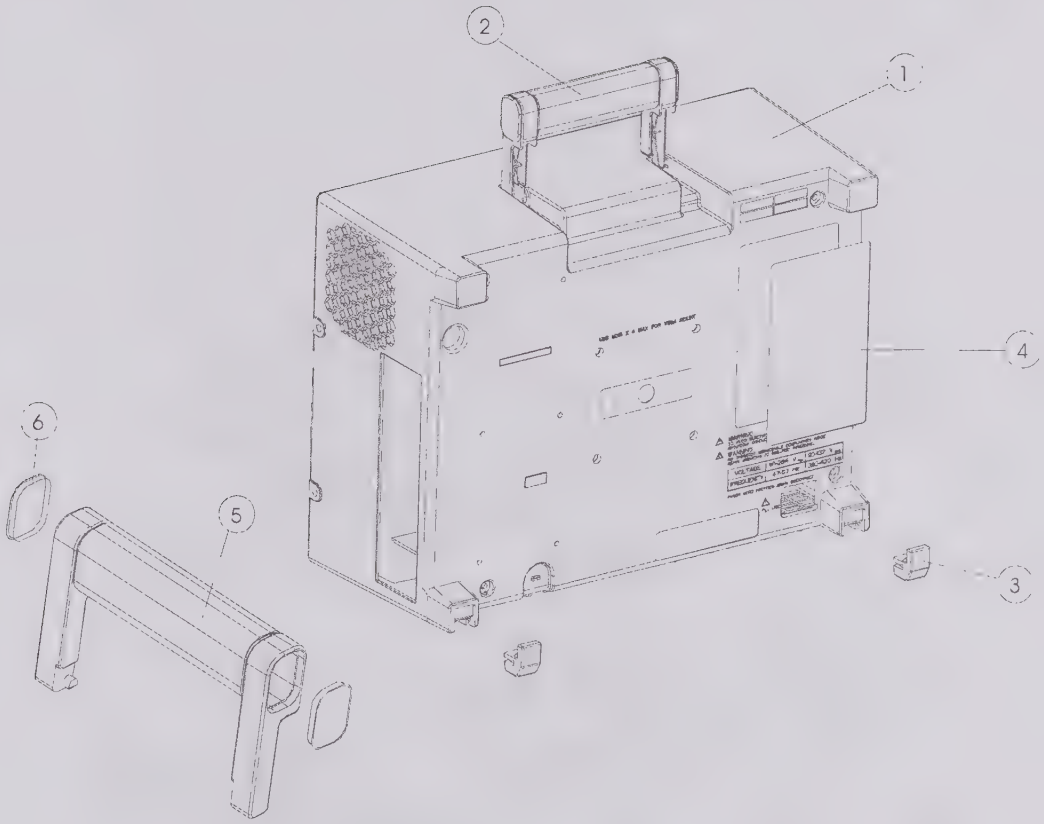


Figure 8-3 Back Shell Assembly

Item	Part Number	Qty	Desciption
1	913331-02	1	WSXs Back Cover
2	913521-02	1	WSXs Handle Assy
3	913339-00	2	Rear Foot
4	913922-00	1	Serial Number Label
5*	913520-02	1	WSXs Handle
6*	913341-02	2	Handle Cap Black
7*	42CH599010003	0	Loctite 409 Instant Adhesive

* part of item 2

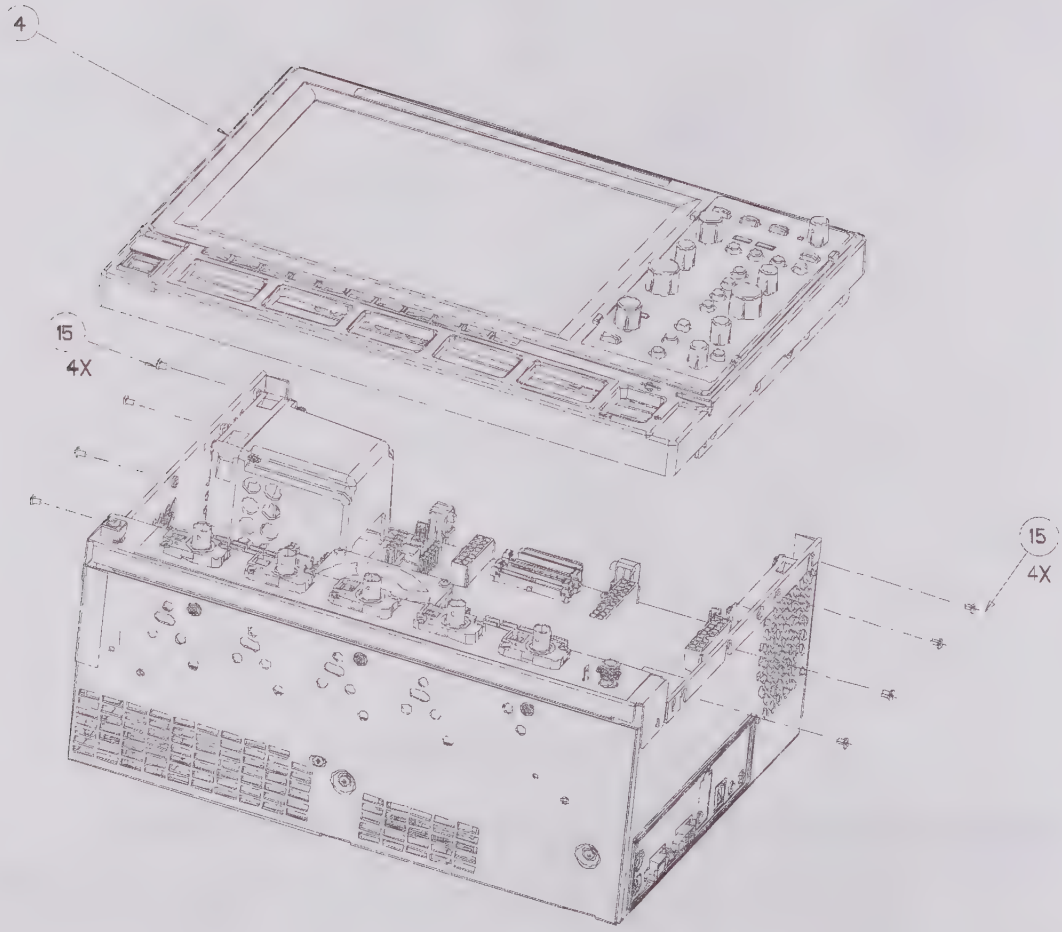


Figure 8-4 Installation of Front Frame

Item	Part Number	Qty	Description
4	See Figure 8-7 & 8-7	12	Front Box Assy
15	913585-00	12	Machine Screw M3 Flat Undercut

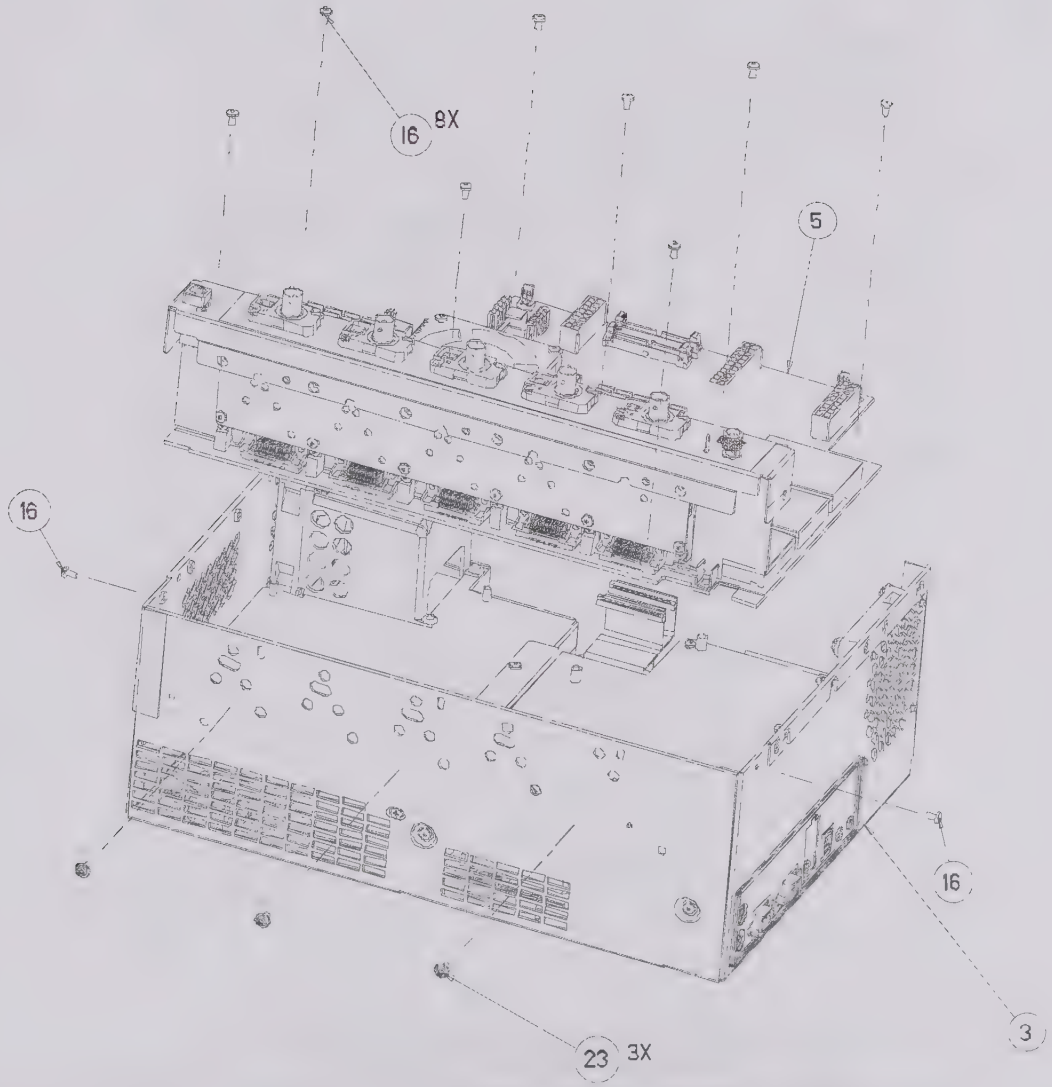


Figure 8-5 Installation of Acquisition System

Item	Part Number	Qty	Description
3	See Figure 8-10 – 8-16	1	Back Box Assy
5	See Figure 8-18	1	400 or 600 MHz/2 of 4ch Acq. System
16	563430006	9	Screw TX PAN M3X0.4-6MM S1
23	563430106	7	Screw TX ECO-FIX M3X0.5-6MM S1

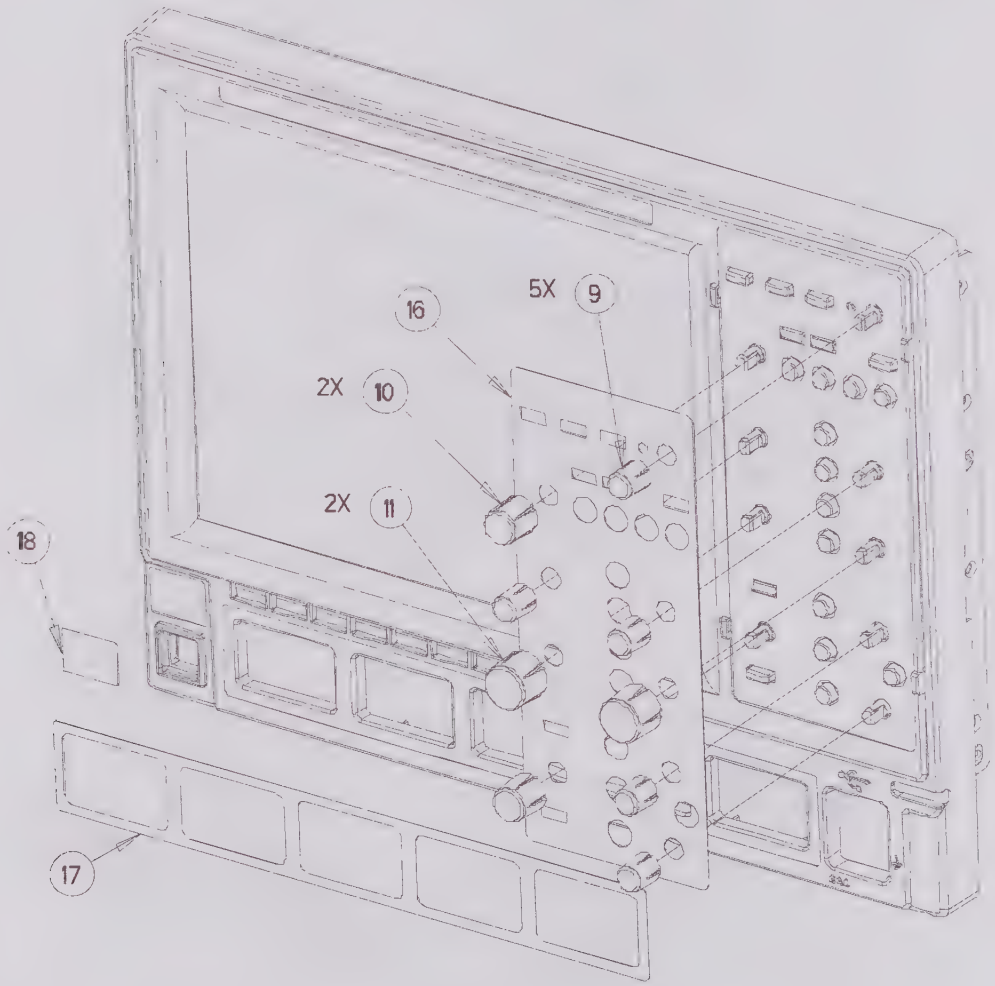


Figure 8-6 Labels & Knobs to Front Frame

Item	Part Number	Qty	Description
9	901582-01	5	WRXi Knob Small
10	901583-01	2	WRXi Knob Medium
11	901584-02	2	WRXi Knob Large
16	913789-00	1	WSXs 4 ch Front Panel Overlay
	913856-00	1	WSXs 2 ch Front Panel Overlay
17	913575-00	1	WSXs 4ch Channel No Overlay
	913794-00	1	WSXs 2ch Channel No Overlay
18	913576-00	1	Input Rating Overlay

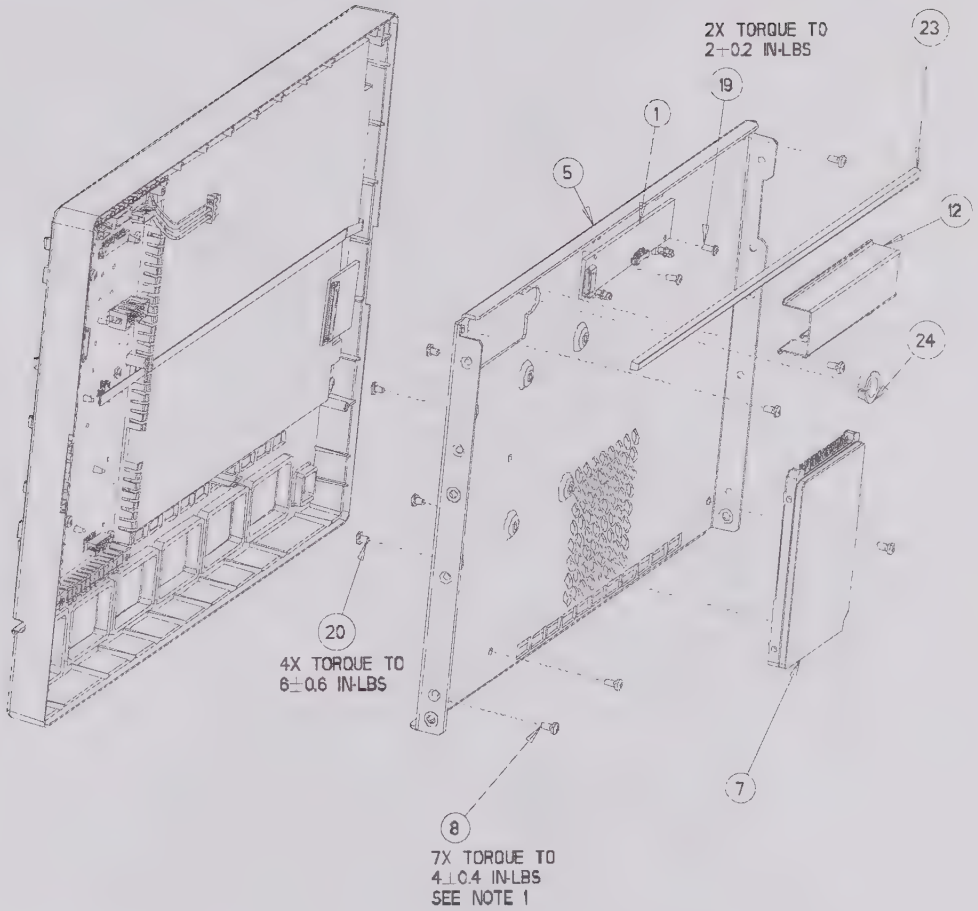


Figure 8-7 Installation of Front Frame to Bezel

Item	Part Number	Qty	Description
1	42258000001	1	DC to AC Inverter
5	913347-00	1	Front Frame
7	330000008	1	Hard Drive 40GB 2.5 in
8	554430003	17	Screw S/Tap Phil M3x6
12	913369-00	1	WSXs Backlight Inverter Shie
19	554425003	2	Screw S/Tap Phil M2.5X6 Black
20	42550000008	4	Screw Pan HD Torx M3x4 w/patch
23	42350480002	1	Gasket EMI Fabric 4mmx4mmx12.5
24	519260005	1	Snap-In Open/Closed Bushing ID

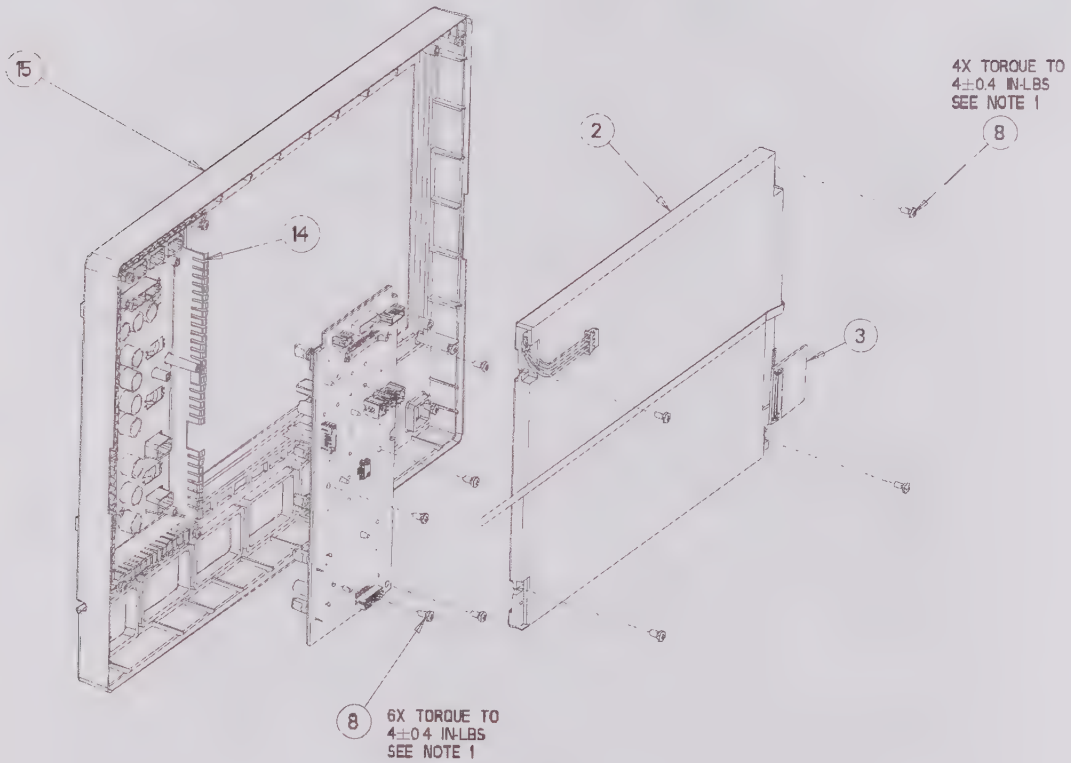


Figure 8-8 Installation of Encoder & TFT to Bezel

Item	Part Number	Qty	Description
2	903118-00	1	Touchscreen Display Assembly
3	903177-00	1	Video Signal Translator PCA
8	554430003	9	Screw S/Tap Phil M3x6
14	913368-00	1	WSXs FP EMI Shield
15	913351-01	1	WSXs Bezel

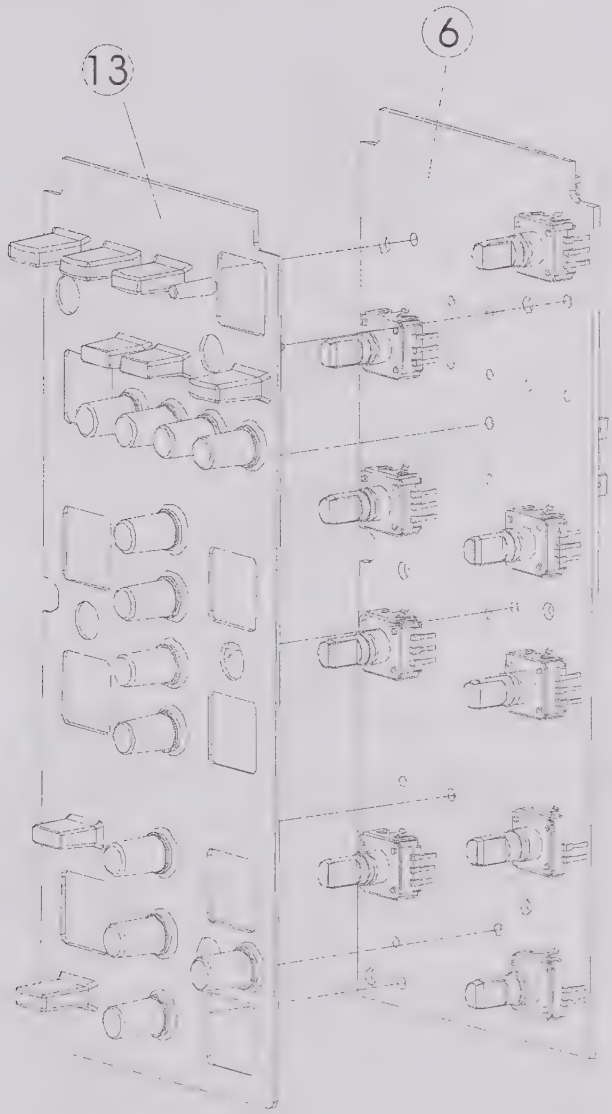


Figure 8-9 Elastomeric Keypad to Encoder Board

Item	Part Number	Qty	Description
6	913620-00	1	WSXs 4 Ch Front Panel PCA
	913620-01	1	WSXs 2 Ch Front Panel PCA
13	913310-00	1	WSXs Elastomeric Keymat

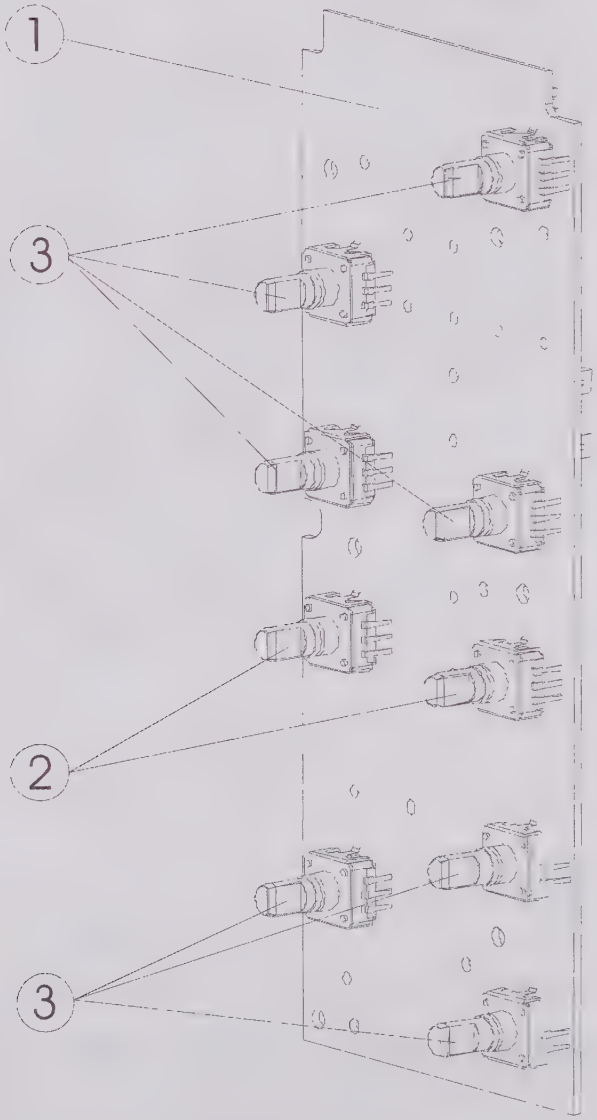


Figure 8-10 Encoders

Item	Part Number	Qty	Description
1	913620-00	1	WSXs 4 Ch Front Panel PCA
1	913620-01	1	WSXs 2 Ch Front Panel PCA
2	42425100001	2	Encoder 20mm Detent
3	42425100003	8	Encoder 20mm Detent JOG PB

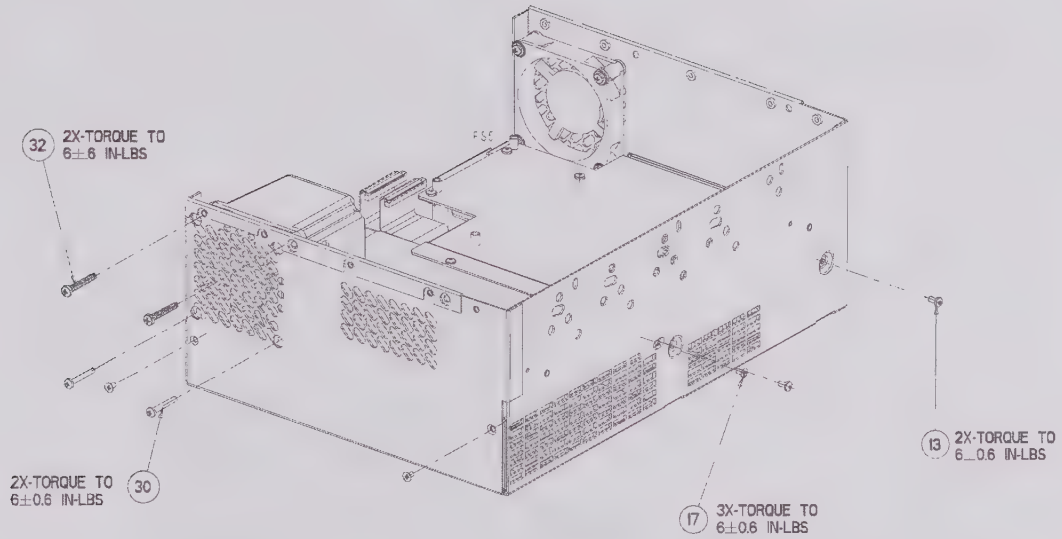


Figure 8-11 Installation of Power Supply Hood

Item	Part Number	Qty	Description
13	563430006	2	Screw TX PAN M3X0.4-6MM S1
17	913585-00	3	Machine Screw M3 Flat Undercut
30	42550000004	2	Screw pan HD Torx M3x22 w/patc
32	42555507001	2	Screw Self Tap Phil # 6-19 x 1

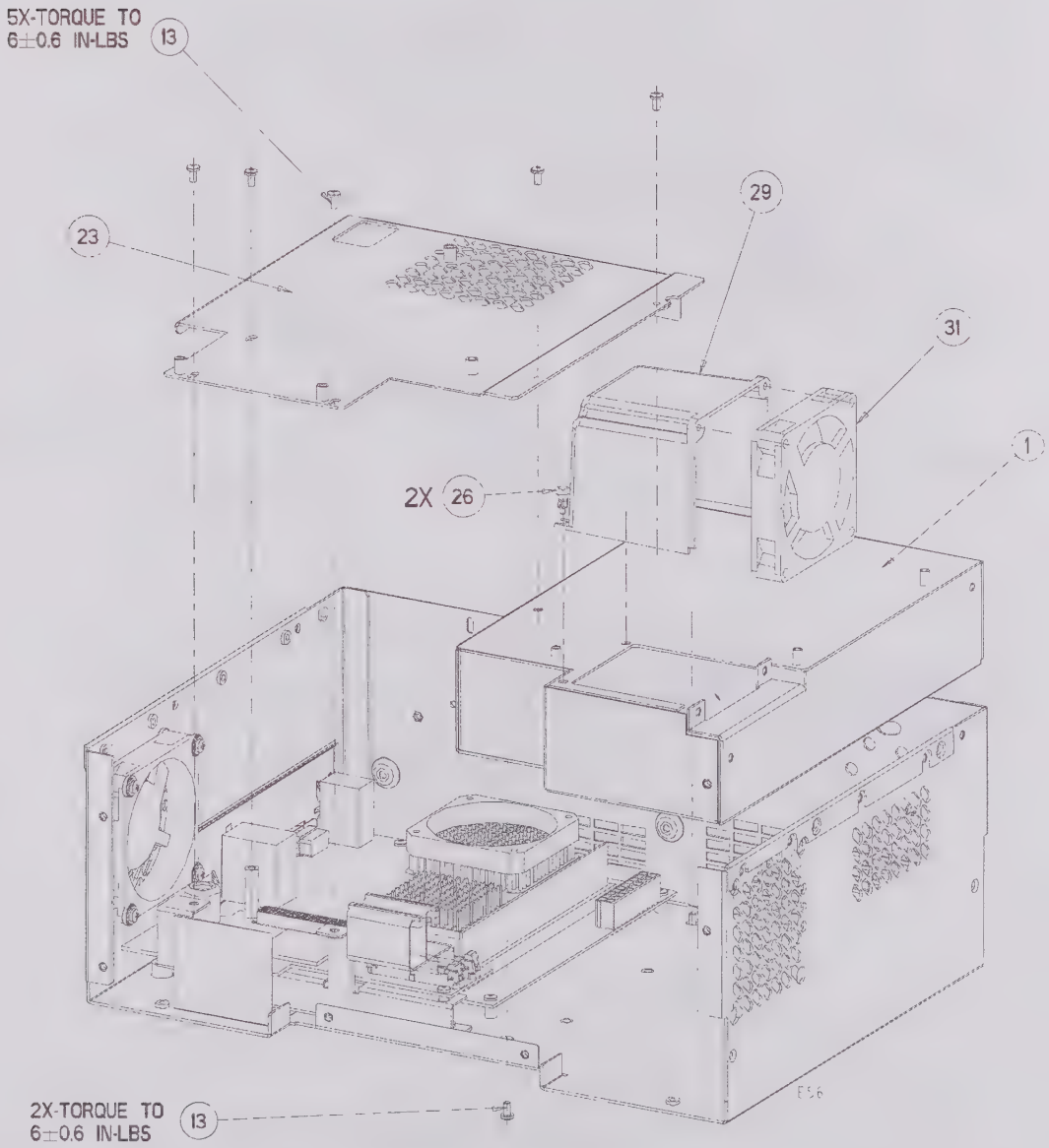


Figure 8-12 Installation of Power Supply to Chassis

Item	Part Number	Qty	Description
1	913212-01	1	WSXs System Power Supply
13	563430006	7	Screw TX PAN M3X0.4-6MM S1
23	913334-00	1	Acquisition Support Plate
26	42519230002	2	Snap Rivet Nylon
29	913530-00	1	Power Supply Hood
31	913882-00	2	70 mm Fan Assembly

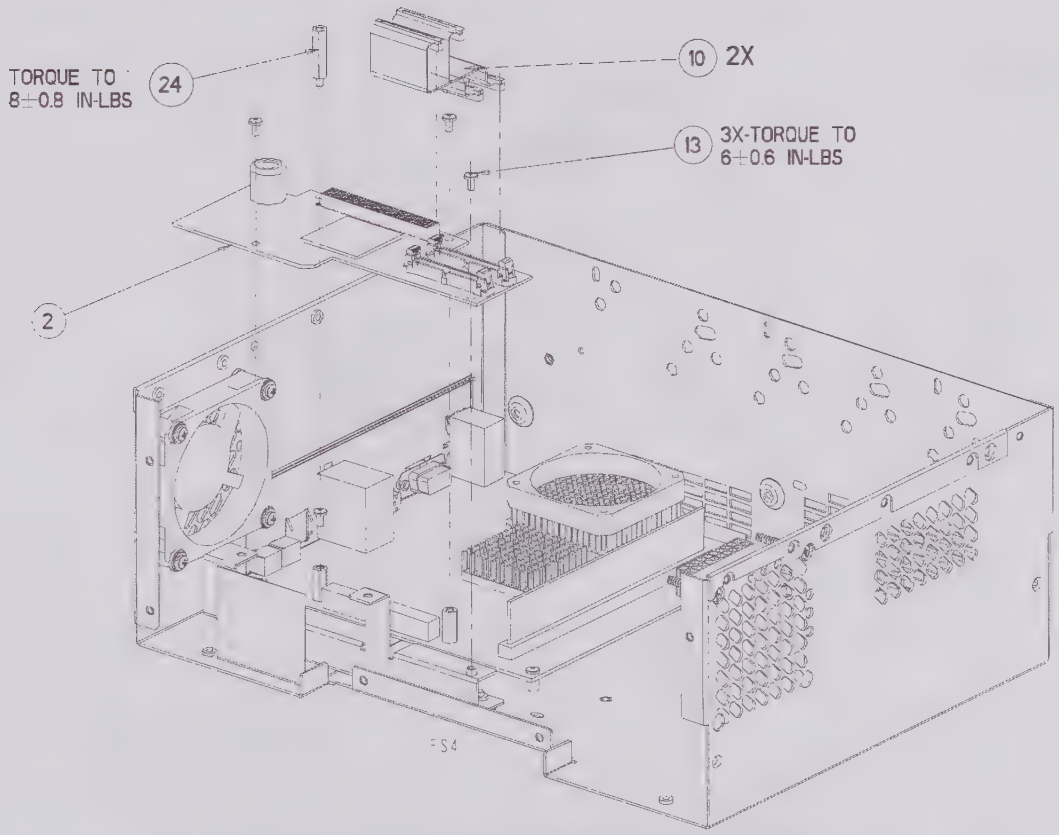


Figure 8-13 Installation of PCI card

Item	Part Number	Qty	Description
2	913315-00	1	PCI to Acq Interface Card
10	42592060001	2	3.0 Inch Cable Assy 50-Pos Rev
13	563430006	3	Screw TX PAN M3X0.4-6MM S1
24	42524105003	1	Standoff 6Hex M/F M3x23

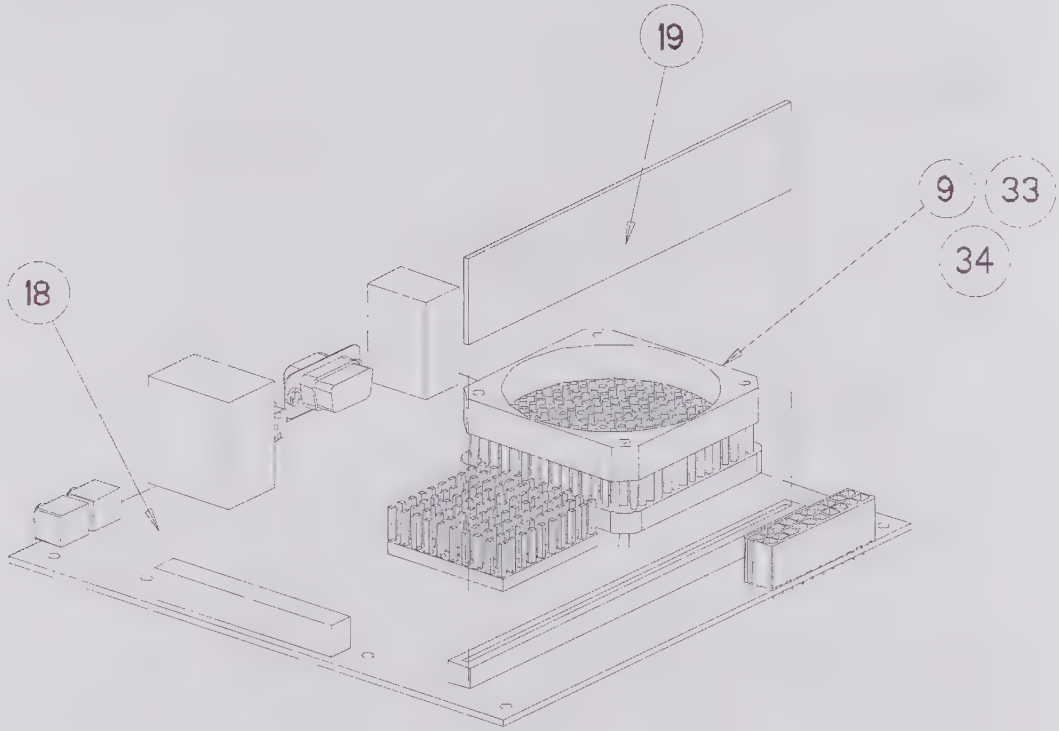


Figure 8-14 Processor Assembly

Item	Part Number	Qty	Description
9	227200012	1	Celeron Processor 1.2 GHz
18	913342-00	1	PC Motherboard MX266-LC
19	42334740001	1	PC RAM 256 MB DIMM
33	42505000001	1	Heatsink Intel Socket 370
34	913796-00	1	60mm Fan Assembly

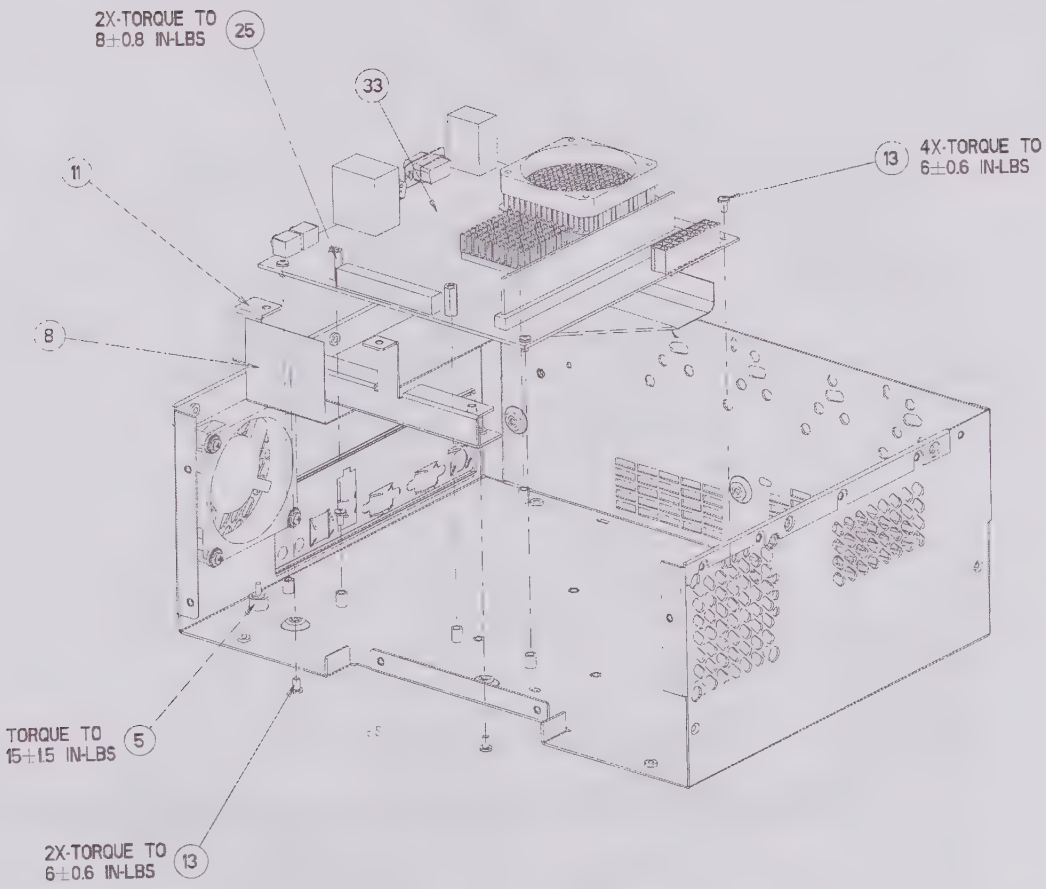


Figure 8-15 Installation of Processor to Chassis

Item	Part Number	Qty	Description
5	913324-00	1	Trigger / Ready and Trig In BNC
8	913373-00	1	Hard Drive Cable Assembly
11	913335-00	1	PCI Support Bracket
13	563430006	6	Screw TX PAN M3X0.4-6MM S1
25	42524105004	2	Standoff M/F Hex M3x15
33	See Figure 8-14	1	Configured CPU Motherboard Assy

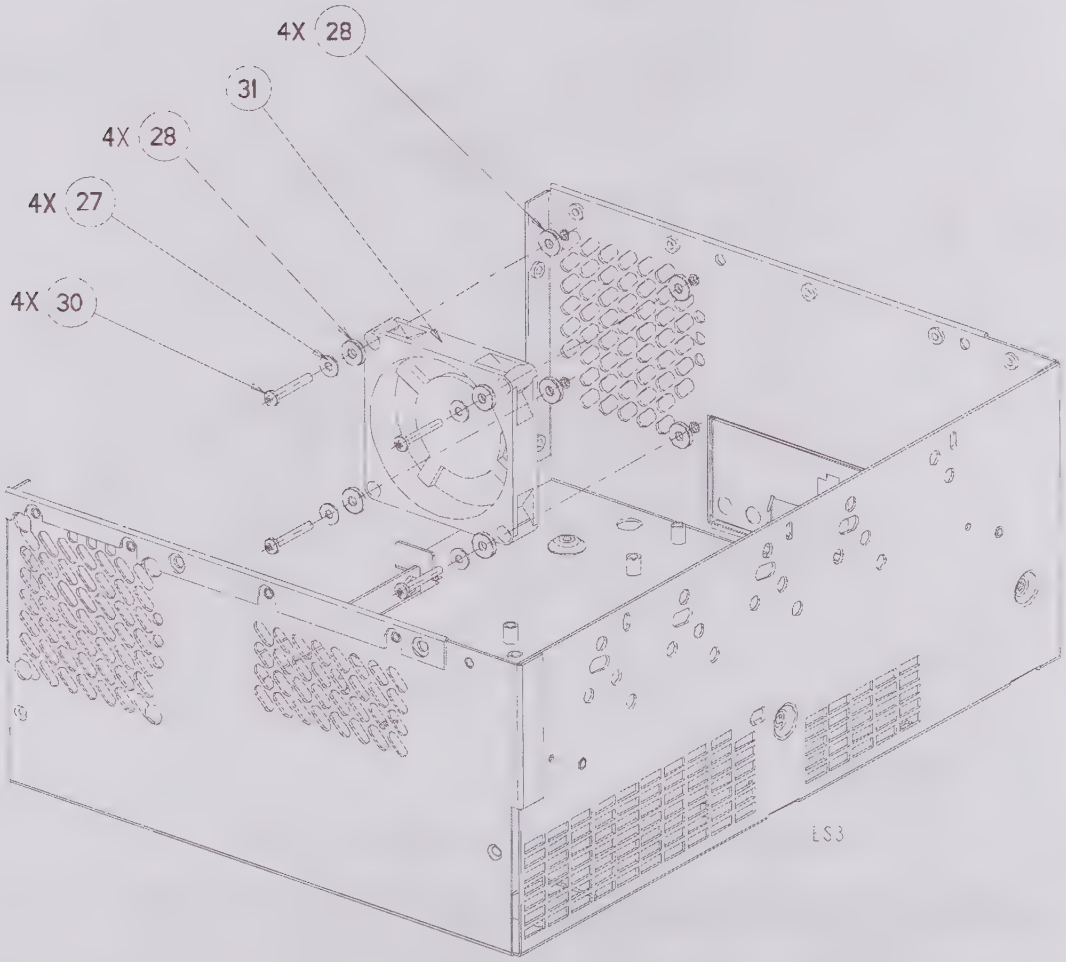


Figure 8-16 Installation of Fan to Chassis

Item	Part Number	Qty	Description
27	42551130100	4	Washer Flat M3 9mm OD
28	42575000001	8	Washer Silicone 2mm Thick
30	42550000004	4	Screw pan HD Torx M3x22 w/patch
31	913882-00	1	70 mm Fan Assembly

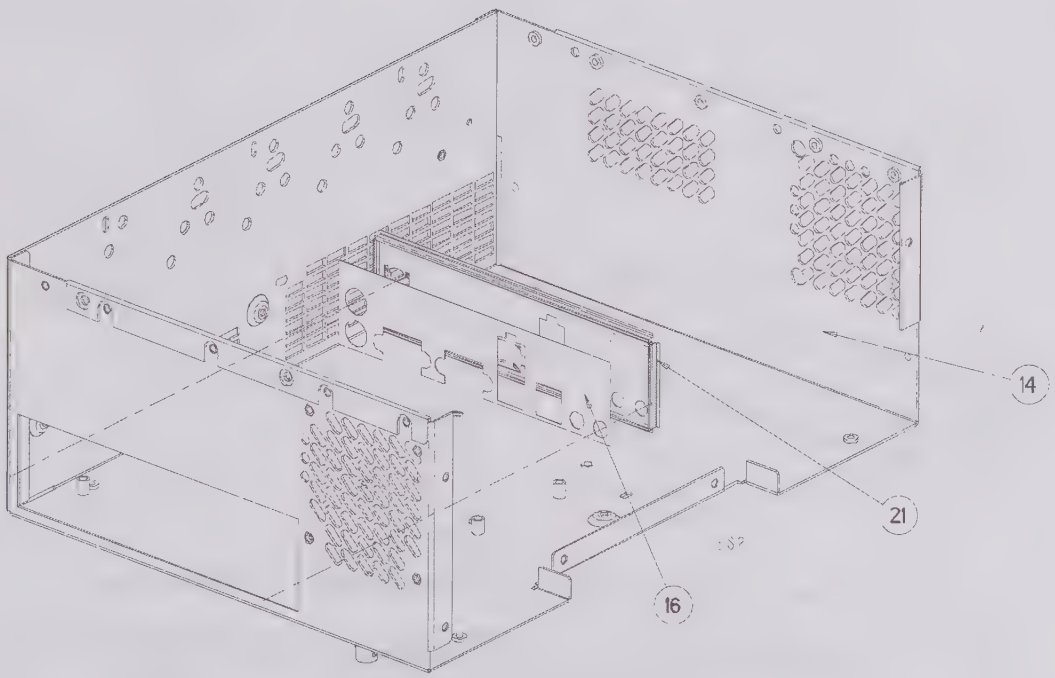


Figure 8-17 Installation of IO shield to Chassis

Item	Part Number	Qty	Description
14	913330-00	1	Chassis Assy
16	913513-00	1	WSXs Motherboard I/O Label
21	913332-00	1	WSXs I/O Plate

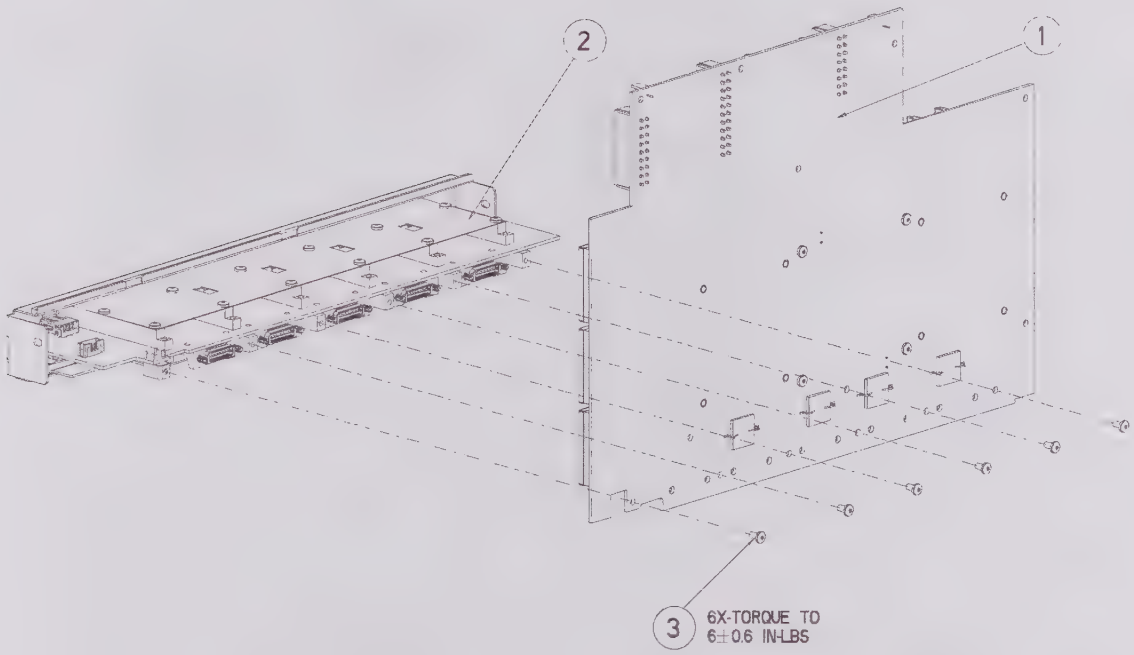


Figure 8-18 Acquisition System Assembly

Item	Part Number	Qty	Description
1	913461-00	1	600 MHz 4ch Acquisition Board
	913461-01	1	400 MHz 4ch Acquisition Board
	913791-00	1	600 MHz 2ch Acquisition Board
	913791-01	1	400 MHz 2ch Acquisition Board
	913461-02	1	200 MHz 4ch Acquisition Board
2	913462-00	1	600 MHz 4ch Front End Board
	913792-00	1	600 MHz 2ch Front End Board
3	563430006	6	Screw TX PAN M3X0.4-6MM S1

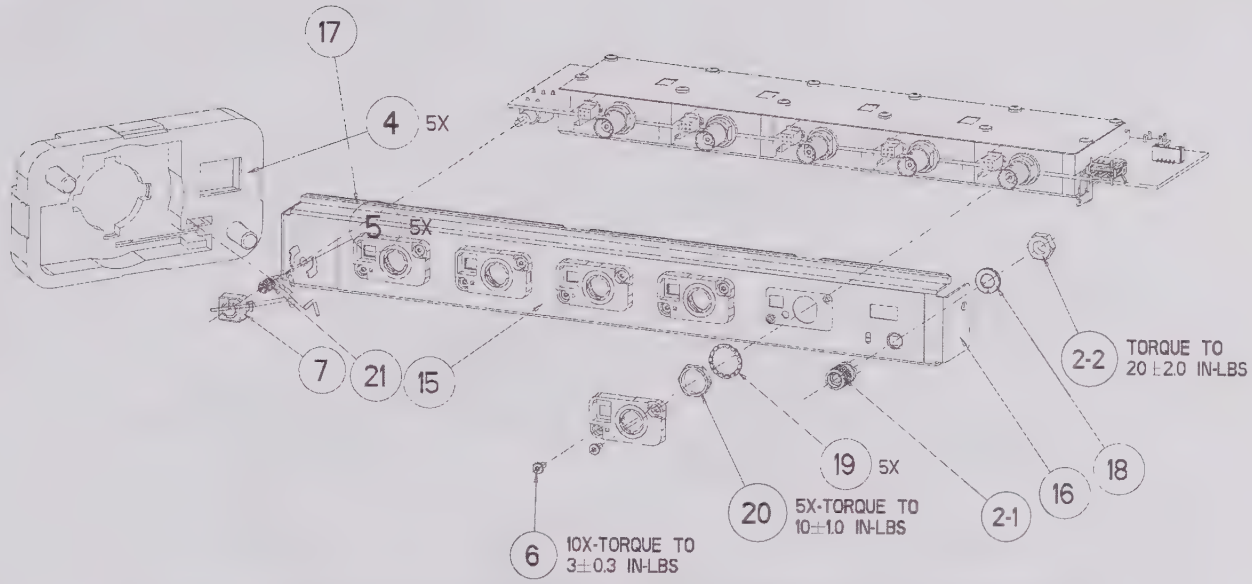


Figure 8-19 Four Channel Front End Main Card Panel Assembly

Item	Part Number	Qty	Description
2	469040002	1	Metal Banana Jack/Binding Post
4	7093XXP41	5	Probe Holder
5	7093XXP91	5	Probe Ring Contact
6	554425003	10	Screw S/Tap Phil M2.5X6 Black
7	913354-00	1	Power Button
15	913578-00	1	Main Card Panel Overlay
16	913327-00	1	WRXi and WSXs Main Card Panel
17	42350480001	1	Gasket EMI Fabric 3x3mmx12.6in
18	555465002	1	Washer Lock Split 1/4
19	709614301	5	BNC Lock Washer
20	709614302	5	BNC Nut
21	42544220001	1	Spring Compression .31 in L

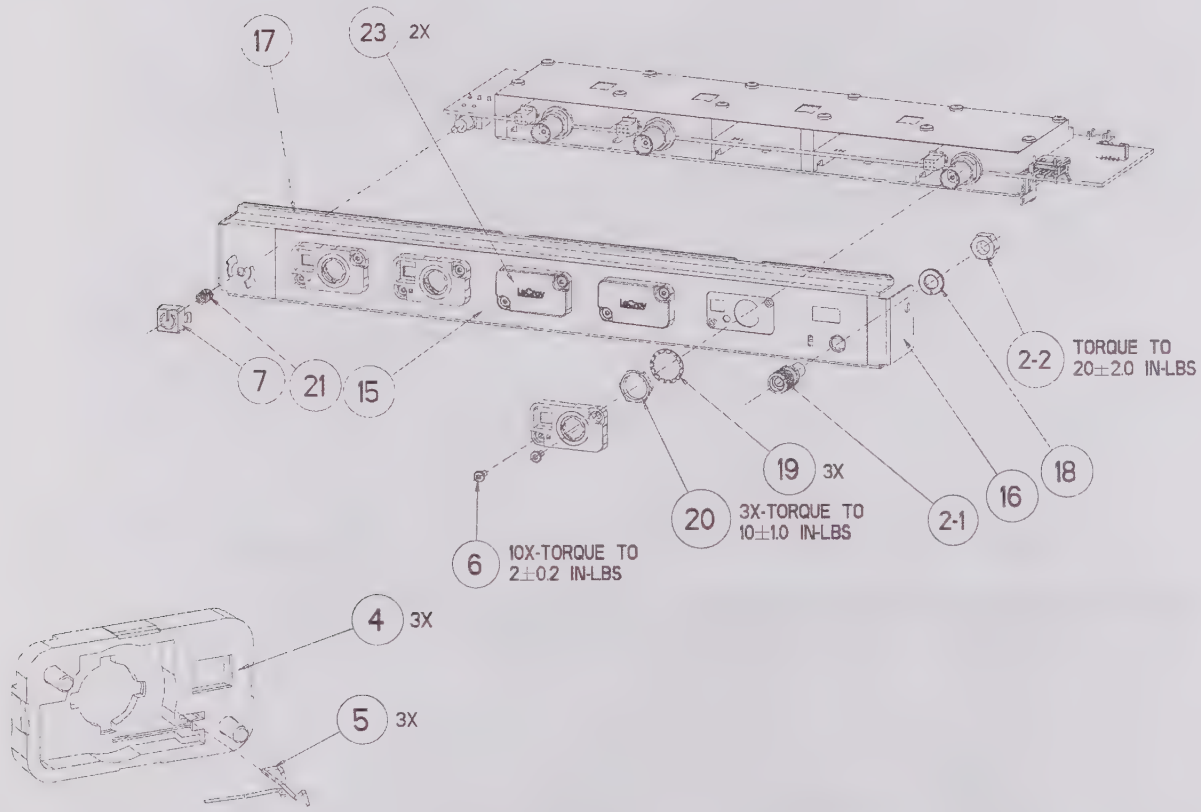


Figure 8-20 Two Channel Front End Main Card Panel Assembly

Item	Part Number	Qty	Description
2	469040002	1	Metal Banana Jack/Binding Post
4	7093XXP41	3	Probe Holder
5	7093XXP91	3	Probe Ring Contact
6	554425003	10	Screw S/Tap Phil M2.5X6 Black
7	913354-00	1	Power Button
15	913578-00	1	Main Card Panel Overlay
16	913327-00	1	WRXi & WSXs Main Card Panel
17	42350480001	1	Gasket EMI Fabric 3x3mmx12.6in
18	555465002	1	Washer Lock Split 1/4
19	709614301	3	BNC Lock Washer
20	709614302	3	BNC Nut
21	42544220001	1	Spring Compression .31 in L
23	913353-00	2	Probus Cover

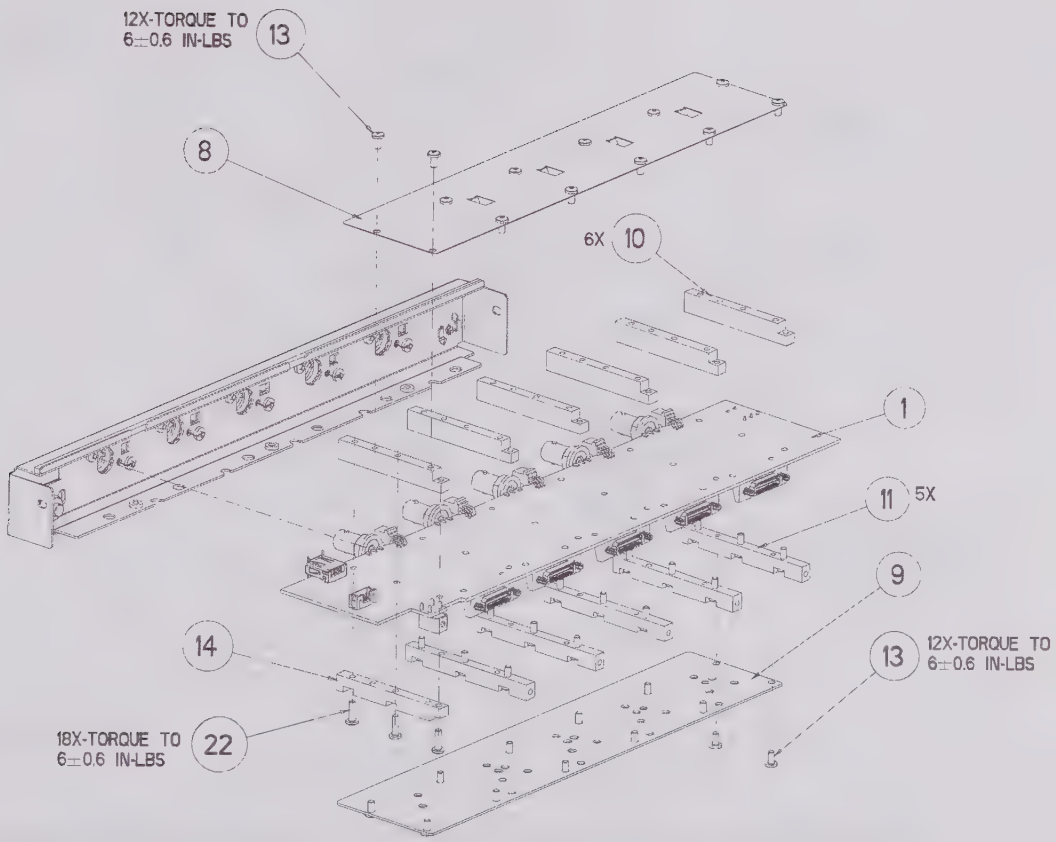


Figure 8-21 Installation of Ribs & Shields to Four Channel Front End Assembly

Item	Part Number	Qty	Description
1	913597-00	1	4 channel Front End PCA
8	913374-00	1	Front End EMI Shield Top
9	913378-00	1	Front End EMI Shield Bottom
10	913379-00	6	Front End EMI Rib Top
11	913380-00	5	Front End EMI Rib Bottom
13	563430006	24	SCREW TX PAN M3X0.4-6MM S1
14	913570-00	1	EMI Rib Bottom Ext
22	42550000003	18	Screw Pan HD Torx m3x10 w/pa

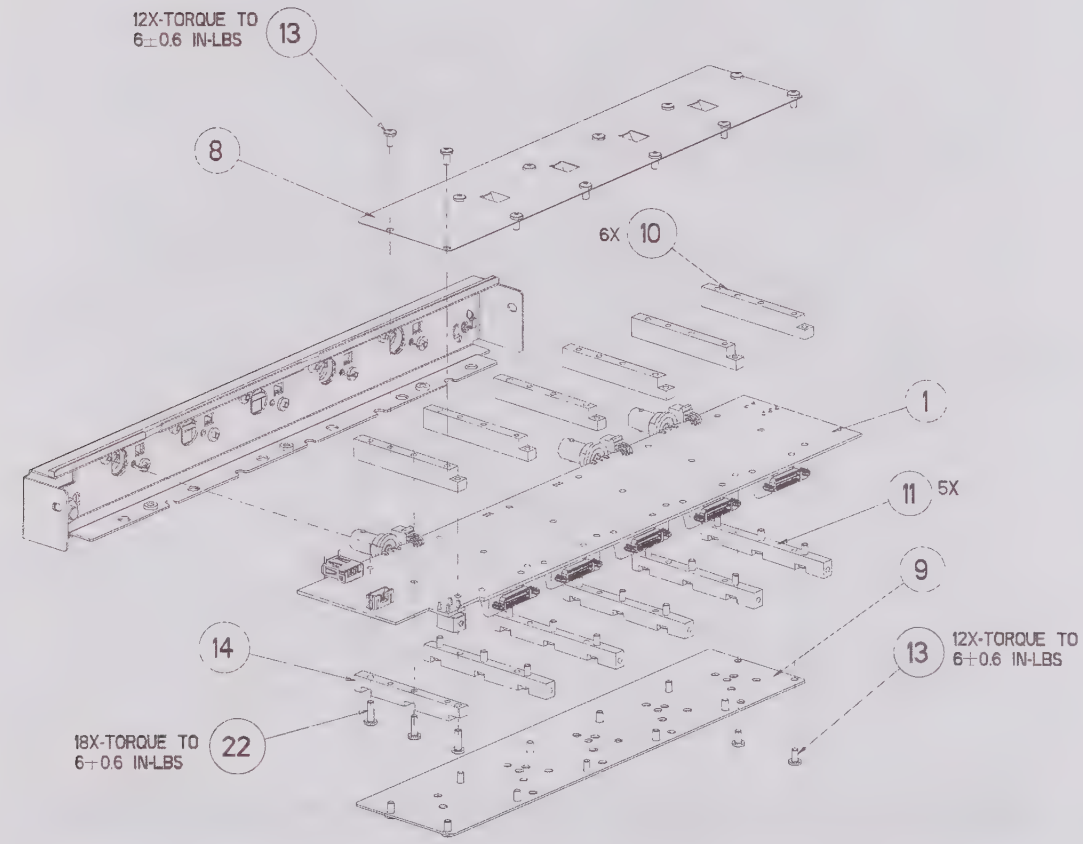


Figure 8-22 Installation of Ribs & Shields to Two Channel Front End Assembly

Item	Part Number	Qty	Description
1	913770-00	1	2 channel Front End PCA
8	913374-00	1	Front End EMI Shield Top
9	913378-00	1	Front End EMI Shield Bottom
10	913379-00	6	Front End EMI Rib Top
11	913380-00	5	Front End EMI Rib Bottom
13	563430006	24	SCREW TX PAN M3X0.4-6MM S1
14	913570-00	1	EMI Rib Bottom Ext
22	42550000003	18	Screw Pan HD Torx m3x10 w/pa

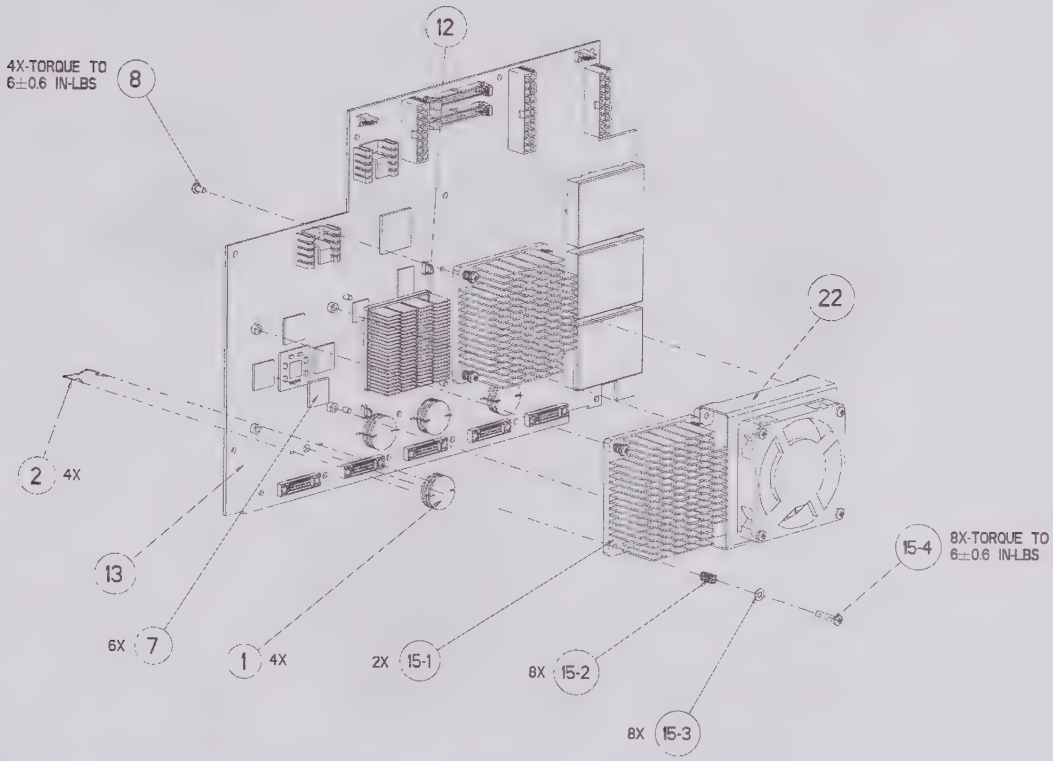


Figure 8-23 Installation of ADC Heatsinks

Item	Part Number	Qty	Description
1	709614330	4	HFE428 Heatsink
2	709614331	4	HFE428 Heatsink Clip
7	902528-00	6	Thermal Gap Pad Die-Cut
8	563430006	4	Screw TX PAN M3X0.4-6MM S1
12	42507000001	1	Heatsink S02GZZ0J 50mm SQ.
13	913582-00	1	600 MHz Acquisition Board PCA
	913582-01	1	400 MHz Acquisition Board PCA
14	CH599041022	1	Heat Sink Compound 251
15	42507000002	2	Heatsink Assembly 70x70x40mm
22	See Figure 8-24	1	MTT Fan Assy

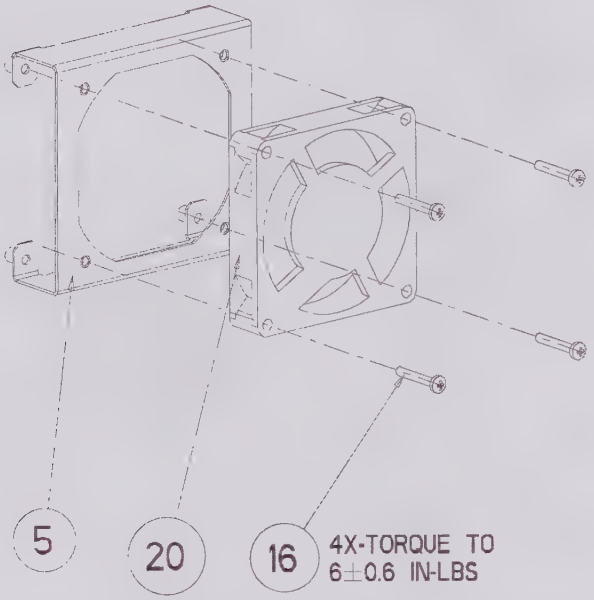


Figure 8-24 MTT fan Assembly

Item	Part Number	Qty	Description
5	913346-00	1	Fan Tray
16	550010120	4	Screw Pan Head Phil M3X20 W/NY
20	913608-00	1	70 mm Fan Assembly

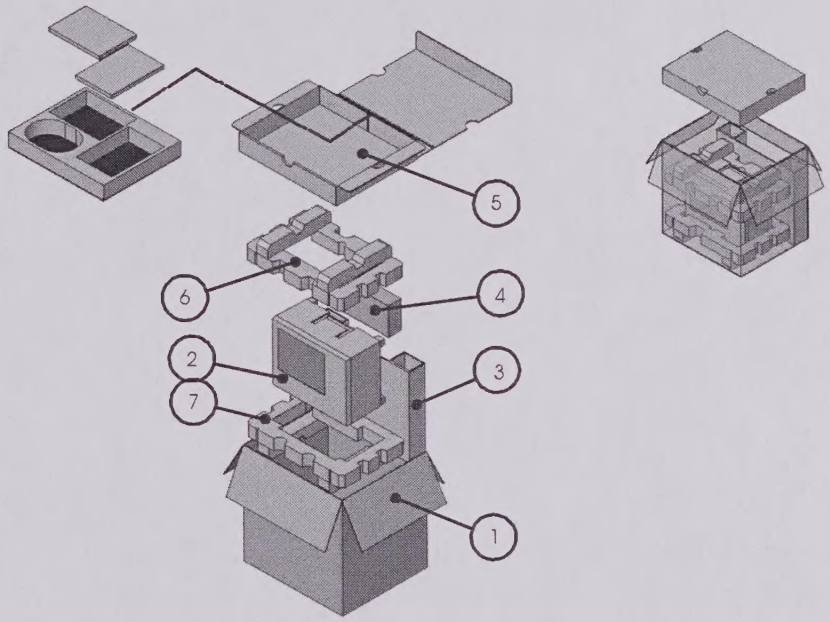


Figure 8-25 Oscilloscope Packaging

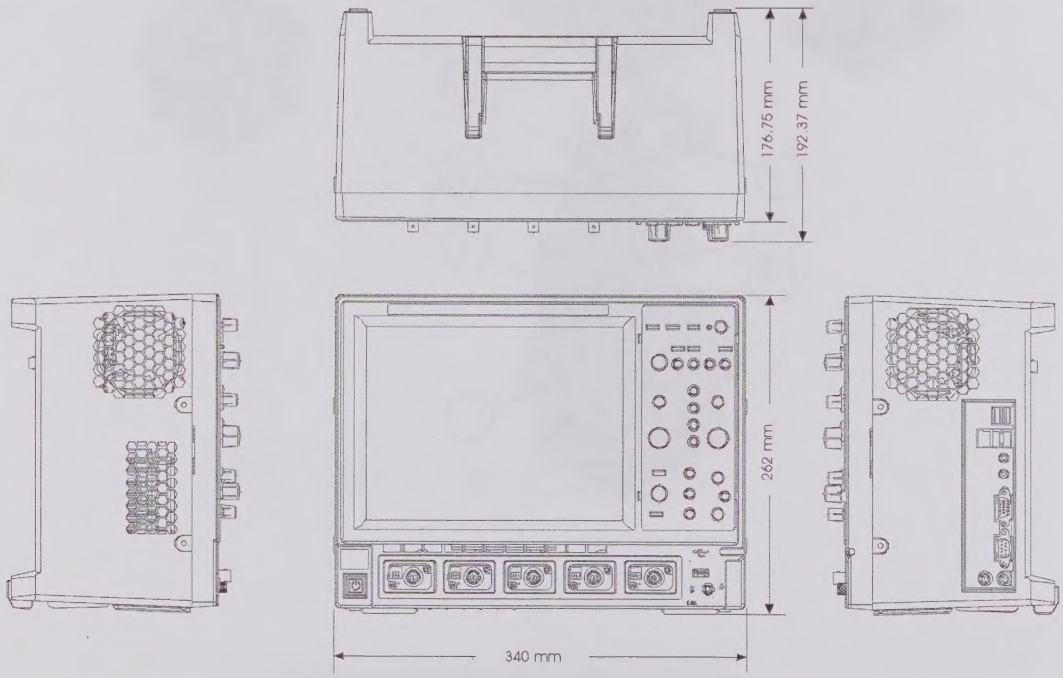


Figure 8-26 Oscilloscope Dimensions

Office Products ©
Brea, California 92821

Durable Slant View 1"

Black #77711 09300
White #77711 09301

www.Avery.com

Product of US Origin with Foreign Components

MP MASTER
MA34440